Breast Cancer Recovery

with the

BOSU®

Balance Trainer

CETI

Cancer Exercise Training Institute

4th Edition

Advanced Qualification

By Andrea Leonard
BA, CES, PES, CPT

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CONTENTS

GENERAL INFORMATION

This handbook is designed to help qualified individuals prepare for the BCRBS home study. The program is designed for medical and fitness professionals who have a strong working knowledge of anatomy and physiology and carry a national certification and/or degree in an exercise or health related field of study. This qualification process is designed to evaluate competence in the participants' knowledge, skills, and abilities found in the BCRBS handbook and accompanying video.

HOME STUDY INFORMATION

The home study option allows you to study the handbook and watch the instructional video at your own pace (within given time allotment). When you are ready, there is a is 100-question multiple choice exam. You must get 80% or better to pass the exam. You will have two chances to take the exam (there will be a re-test fee of $50 thereafter). Upon completion and passing, you will receive your BCRBS Advanced Qualification Certificate, CEU's, and be added to our online listing of International Cancer Exercise Specialists®.

QUALIFICATION RENEWAL

In an attempt to ensure ongoing competency and to maintain a high standard for qualified professionals, BCRBS qualifications must be renewed **every two years.** You will be given a two-month grace period after their qualification expires in which to take the examination. CEU's will vary from certification to certification. You can purchase the re-qualification at www.thecancerspecialist.net under the professionals tab.

REFUND POLICY

We want you to be happy with the course! However, if the timing doesn't work, or you are not satisfied with your purchase, you have 14 days to request a refund. After 14 days there will be no refunds.

BREAST CANCER RECOVERY BOSU® SPECIALIST ADVANCED QUALIFICATION

The Breast Cancer Recovery BOSU® Specialist is a professional qualified to assess, design, and implement individual and group exercise programs for individuals diagnosed with cancer. The BCRBS is skilled in evaluating health behaviors and risk factors, conducting comprehensive fitness assessments, writing appropriate exercise recommendations, and motivating individuals to modify negative health habits and maintain positive lifestyle behaviors for health promotion. The BCRBS will have a complete understanding of the entire breast cancer process from diagnosis to treatment, recovery, identification, prevention and management of lymphedema, and contraindications. The qualification process includes demonstrating competency through a comprehensive multiple choice examination. It is granted to candidates who score eighty percent or higher on the examination.

RECOMMENDED QUALIFICATIONS

1.	2.	3.	4.	5.	6.
Educational training comparable to an undergraduate degree in health and fitness or a closely related field	Adequate knowledge of and skill in risk factor identification, fitness appraisal, exercise recommendations, and basic nutrition	Demonstrated ability to incorporate suitable and innovative activities that will improve an individuals' functional capacity in conjunction with their cancer treatment and surgical procedures	Demonstrated ability to effectively counsel individuals regarding lifestyle modification	Demonstrated competence in the knowledge and skills required for the BCRBS	Current CPR

Course Description

Health and fitness professionals will expand their knowledge base by learning all stages of cancer treatment, side-effects, and reconstructive procedures and how they apply to and/or contradict exercise programming.

No two clients will have the same exercise and physical activity recommendations; each person is unique given their many permutations and combinations of their own health challenges and pre-existing medical and orthopedic conditions.

Objectives:

- Demonstrate an understanding of the diagnosis and treatment of cancer
- Demonstrate an understanding of the different surgeries, including breast reconstruction and the impact of these surgeries on physical mobility
- Understand the signs and symptoms of upper and lower extremity lymphedema and how to prevent, identify, and manage it
- Perform a comprehensive postural assessment to determine muscle imbalances and address chronic pain issues
- Perform joint range of motion assessments with a goniometer to determine the cause of ROM limitations
- Develop a comprehensive rehabilitation program using a variety of approaches including Group Fitness, Personal Training, BOSU®, Pilates, and Yoga exercises
- Develop a strategic exercise program and progression for each client/patient

The Role of a Breast Cancer Recovery BOSU® Specialist®

Responsibilities:

- Improve overall physical strength and flexibility
- Correct muscle imbalances
- Prevent / manage lymphedema and other potential side effects of treatments
- Increase range of motion and correct postural deviations
- Reduce pain and fatigue
- Design, prescribe and teach personalized programs
- Stay in the “educational loop” – this is only the first step in your educational process as a Breast Cancer Recovery BOSU® Specialist®. The information is ever-changing, and it is critical for you to stay on top of current research and changes in the medical arena.

Sample Questions & Answers

The following sample questions will help the student assess his or her knowledge base in preparation for the multiple choice BCRBS examinations. The questions reflect the type of question asked and the depth of knowledge expected. The answers follow the last question. The student is encouraged to review in detail, those topics for which his/her answers were incorrect.

1) The function(s) of the lymphatic system is/are:

- **a)** aiding the immune system in protecting the body from disease
- **b)** returning fluids to the blood in the circulatory system
- **c)** transporting fat from the digestive tract to the blood
- **d)** filtering bacteria, viruses, tissue debris, and other foreign substances from body fluids
- **e)** all of the above

2) After an Abdominal TRAM procedure, particular attention must be paid to strengthening which of the following muscle groups in order to stabilize the torso?

- **a)** obliques and intercostals
- **b)** latissimus dorsi
- **c)** erector spinae
- **d)** both a and c
- **e)** all of the above

3) A potential client forwards their medical release form to their doctor. The doctor will not give their approval for the client to participate at this time. However, the client still wants to participate. You should:

- **a)** give them the proper paperwork and get them enrolled before they change their minds
- **b)** suggest they be reevaluated by their doctor and check back with you later
- **c)** allow them to enroll, but let them know that they will only be allowed to do stretching and range of motion exercises until you have their doctor's permission
- **d)** give them some stretches to work on and suggest they do them for a few weeks before they go back to their doctor for reevaluation
- **e)** both a and c

4) We currently know that lymphedema may be caused by:

- **a)** radiation treatment to the lymph nodes
- **b)** lifting weights in excess of 12 lbs.
- **c)** antidepressant use
- **d)** drinking more than 8 glasses of water daily
- **e)** none of the above

5) Clients undergoing chemotherapy/radiation will reap the same physiological training results as those not undergoing treatment.

- **a)** true
- **b)** false

6) Which of the following is not a sign of cancer fatigue?

- **a)** lack of interest in normal day-to-day activity
- **b)** increased appetite
- **c)** increased time spent lying in bed or sleeping
- **d)** not having enough energy to do normal activities
- **e)** all of the above

7) The fingertip wall walk will help to do which of the following?

- **a)** increase ROM in shoulder abduction and flexion
- **b)** increase ability to externally rotate
- **c)** improve shoulder extension
- **d)** prevent lymphedema
- **e)** none of the above

8) With radiation therapy, pain is often associated with which of the following?

- **a)** breakdown of mucous membranes
- **b)** scarring of the nerves (fibrosis)
- **c)** swelling
- **d)** skin sores
- **e)** all of the above

9) You are scheduled to begin training a woman with a slight case of lymphedema. Prior to your first workout you should do which of the following?

- **a)** contact their doctor for permission
- **b)** contact their physical therapist or lymphedema specialist
- **c)** instruct them to wear their sleeves or wraps as prescribed by their doctor or therapist
- **d)** both a and b
- **e)** all of the above

10) Osteosarcoma is the most common kind of:

- **a)** breast cancer
- **b)** osteoarthritis
- **c)** osteoporosis
- **d)** bone cancer
- **e)** none of the above

11) To help to prevent the onset of lymphedema, a patient should practice which of the following precautions?

- **a)** use moderation when working the affected body part
- **b)** always get blood drawn or shots given in the unaffected arm or leg
- **c)** elevate the affected arm or leg whenever possible
- **d)** both b and c
- **e)** all of the above

12) All of the following are road blocks to pain control except:

- **a)** nausea
- **b)** sedation
- **c)** hallucinations
- **d)** premature ventricular contractions
- **e)** allergic reactions

13) Prior to beginning or resuming a strength training routine after a mastectomy, your client should have 90% or better range of motion in her affected arm.

- **a)** true
- **b)** false

14) Prior to beginning or resuming a strength training routine after a mastectomy, your client should have 90% or better range of motion in her affected arm.

- **a)** true
- **b)** false

15) What precautions must be taken with a client who has undergone an extensive cervical lymph-node dissection for medullary thyroid cancer

- **a)** don't let client overheat
- **b)** make sure that they stay well hydrated
- **c)** use moderation for all upper back and neck strength training
- **d)** emphasize stretching of the neck area
- **e)** all of the above

16) Somatic pain can be described by which of the following:

- **a)** sharp pain
- **b)** aching
- **c)** throbbing pain
- **d)** b and c only
- **e)** all of the above

17) At which stage is lymphedema still potentially reversible?

- **a)** stage I
- **b)** stage II
- **c)** stage III
- **d)** stage IV
- **e)** none of the above

18) You notice that your client's affected arm is swollen after the completion of their workout. Which of the following choices is appropriate under the circumstances?

- **a)** have them exercise at a lower intensity
- **b)** perform lymph drainage exercises
- **c)** tell them that they have lymphedema and instruct them to wear a compression sleeve
- **d)** call 911
- **e)** them see their doctor to eliminate the possibility of lymphedema

19) Shoulder range of motion limitations (ROM) are not uncommon following a mastectomy. It is important to address these issues because they can lead to which of the following?

- **a)** frozen shoulder
- **b)** necrosis
- **c)** muscle atrophy
- **d)** lyctic lesions
- **e)** none of the above

20) The CES certification is good for:

- **a)** one year
- **b)** two years

ANSWERS TO SAMPLE TEST QUESTIONS

1. E / 2. D / 3. B / 4. A / 5. B / 6. B / 7. A / 8. E / 9. E / 10. D / 11. E / 12. D / 13. B / 14. A / 15. E / 16. E / 17. A / 18. E / 19. A / 20. B

EXAMINATION SCORING

The examination process should take approximately 2-3 hours. To pass the exam, a score of eighty percent or better will be required. A failing score will require re-testing in order to issue your certificate.

INTRODUCTION

CYNTHIA AKS, DO FACOS, ABIHM

- Breast Surgical Oncologist
- Breast Program Director
  Legacy Cancer Institute
  Mount Hood Medical Center

It is with gratitude and honor to write the introduction to Andrea Leonard's 13th edition of the Cancer Exercise Specialist Advanced Qualification Modules. I am a Surgical Oncologist board certified in General Surgery and Integrative Medicine, currently a certified 500hr yoga teacher and Reiki Master with special interest and education in Nutrition, Ayurveda, Environmental Toxins and Aromatherapy. I have specialized in Breast Disease for 3 decades treating breast cancer patients, high risk individuals and performing genetic counseling and testing. As a result, I have come to interact with patients from a multitude of perspectives and educate, inspire, motivate and provide resources for all things related to optimizing health and wellness from a holistic perspective. I discuss key fundamentals of health with every patient including breathing, hydration, nutrition, exercise, sleep, stress management, mindfulness and gratitude. These are all necessary and interconnected physically, mentally, emotionally and spiritually.

Let us look at exercise in general: Moving the body increases movement of body fluids which helps with detoxification, increases breathing and oxygenation, reduces stress hormones, aids with sleep and weight management, stimulates the production of nourishing physiologic substances, makes one feel better, improves mood and self-esteem, reduces fatigue, improves strength, mobility, flexibility, balance and lubricates joints and other tissues. Why are these things important from a cancer perspective? Most cancer patients experience fatigue, insomnia, mood disorders e.g., anxiety, fear, depression and grief. Cancer treatment may result in weight changes and loss of muscle mass. Neuropathy may develop which can affect balance and increase risk of falling, chronic pain e.g. myalgia and arthralgias and neuropathy pain, bone density loss which increases risk of fracture and overall negatively impair quality of life. Exercise, tailored specifically to the needs of an individual patient, can help to reverse or minimize symptoms and improve their quality of life and their health span.

Growing up in a traditional medical family and having been trained as a nurse then surgeon, my training focused on western conventional treatment of cancer to include either cut it out, poison it to death and/or burn the heck out of it. (surgery, chemotherapy, radiation). In medical school I learned about body systems and disease, studied the "pill for the ill", in surgical residency I learned how the skillfully rid a patient of their existing abnormality, but it wasn't until I had years of caring for people that I learned that treating a condition is not the same as healing a person. This realization launched me on a holistic path to become a better healer. One of the lessons that has revealed itself is that we must address the whole person: mind, body, emotion, spirit in order to successfully achieve health related goals.

Here are some of the statistics we face in our world today:

What is cancer?

A human cell is born from a similar cell, performs a specific job in the body, maintains and nurtures itself, reproduces itself in a limited number of times and is programmed to die (apoptosis). A cancer, in simple terms, is a normal cell that went awry. A cell that lost all normal regulatory control, grows chaotically and is immortal. Cancer is not one disease. It is a systemic disease with multiple and complex root causes. The human body and its essences are extremely complex, and it seems that the more we learn about cells and disease, the more we realize how much we still don't know. We each are also so incredibly unique. Only 10% of our cells are human cells and the rest are of microbial origin.

Our world is getting sicker quicker.

According to the World Health Organization (WHO), cancer is the second leading cause of death worldwide (WHO, 2018). Cancer accounts for 17% of all deaths worldwide or 8.8 million deaths. With population aging and globalization, cancer deaths are estimated to exceed 13 million by 2030. The leading causes of cancer death differ between men and women, and between developed and less developed countries. This reflects differences in the population age structure, burdens of tobacco use, cancer-associated dietary/lifestyle factors, access to care issues, and cancer-causing infectious agents.

In the U.S., cancer has remained the second overall leading cause of death, exceeded only slightly by deaths due to heart disease (Weir, 2016). In adults age 45-64 years of age, cancer is the leading cause of death and for younger adults, cancer is the primary cause of death due to disease (Sonnenschein, 2005). According to data from SEER, the National Program of Cancer Registries and the N. American Association of Central Cancer Registries, projected new cancer cases in 2019 are 1.76 million with 606,88 projected cancer deaths (Siegel, 2019).

Ten Leading Cancer Types for the Estimated New Cancer Cases and Deaths by Sex, United States, 2020. Estimates are rounded to the nearest 10 and exclude basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder. Ranking is based on modeled projections and may differ from the most recent observed data.

The lifetime probability of being diagnosed with invasive cancer is slightly higher for men (40.1%) than for women (38.7%) (Table). The reasons for the excess risk in men are not fully understood, but probably largely reflect differences in environmental exposures and endogenous hormones, as well as complex interactions between these influences. Recent research suggests that sex differences in immune function and response may also play a role.[24] Adult height, which is determined by genetics and childhood nutrition, is positively associated with cancer incidence and mortality in both men and women,[25] and has been estimated to account for one-third of the sex disparity.[26] Notably, the gender gap varies by age. For example, cancer incidence during childhood (ages birth-14 years) is approximately 10% higher in males than in females (18.2 vs 16.4 per 100,000 population),[27] whereas during early adulthood (ages 20-49 years) it is 77% higher in females (203.4 vs 114.9 per 100,000 population), largely because of breast cancer incidence in young women.[28]

Cancer statistics, 2020

Estimated New Cases

Males			Females		
Prostate	191,930	21%	Breast	276,480	30%
Lung & bronchus	116,300	13%	Lung & bronchus	112,520	12%
Colon & rectum	78,300	9%	Colon & rectum	69,650	8%
Urinary bladder	62,100	7%	Uterine corpus	65,620	7%
Melanoma of the skin	60,190	7%	Thyroid	40,170	4%
Kidney & renal pelvis	45,520	5%	Melanoma of the skin	40,160	4%
Non-Hodgkin lymphoma	42,380	5%	Non-Hodgkin lymphoma	34,860	4%
Oral cavity & pharynx	38,380	4%	Kidney & renal pelvis	28,230	3%
Leukemia	35,470	4%	Pancreas	27,200	3%
Pancreas	30,400	3%	Leukemia	25,060	3%
All Sites	**893,660**	**100%**	**All Sites**	**912,930**	**100%**

Estimated Deaths

Males			Females		
Lung & bronchus	72,500	23%	Lung & bronchus	63,220	22%
Prostate	33,330	10%	Breast	42,170	15%
Colon & rectum	28,630	9%	Colon & rectum	24,570	9%
Pancreas	24,640	8%	Pancreas	22,410	8%
Liver & intrahepatic bile duct	20,020	6%	Ovary	13,940	5%
Leukemia	13,420	4%	Uterine corpus	12,590	4%
Esophagus	13,100	4%	Liver & intrahepatic bile duct	10,140	4%
Urinary bladder	13,050	4%	Leukemia	9,680	3%
Non-Hodgkin lymphoma	11,460	4%	Non-Hodgkin lymphoma	8,480	3%
Brain & other nervous system	10,190	3%	Brain & other nervous system	7,830	3%
All Sites	**321,160**	**100%**	**All Sites**	**285,360**	**100%**

CA: A Cancer Journal for Clinicians, Volume: 70, Issue: 1, Pages: 7-30, First published: 08 January 2020, DOI: (10.3322/caac.21590)

With widespread screening in the United States, prostate cancer (18.5%) and breast cancer (23.8%) are the most common cancers for men and women, respectively (IARC, 2019). However, the major cause of cancer death for both men and women in the U.S. remains death from lung and bronchus cancers, 25% and 24.5% respectively (IARC, 2019). From data collected from 2006 - 2015, the cancer incidence rate has been stable in women and declined by approximately 2% per year in men, and the cancer mortality rate has declined annually by 1.4% in women and 1.8% in men (Siegel, 2019).

Experts agree that approximately 5-10% of cancers are due to inherited propensity (NCI, 2020). However, they are divided as to the percentage attributable to extrinsic factors, such as environmental exposures or behavior, versus stochastic effects of stem cell division and faulty gene repair, or "bad luck" (Wodarz, 2015). Estimates for the "bad luck" hypothesis range from 30% to 70% and the mathematical modeling used to arrive at these estimates is under debate (Tomasetti, 2015; Björk, 2019). Accepting even the 30% estimate, however, leaves room for much improvement in prevention efforts aimed at reducing tobacco and alcohol use, sedentary behavior, excess caloric ingestion, and low produce intake (Tomasetti, 2015; Wu, 2016).

When we exercise our body, we receive all the benefits as mentioned above. This strengthens our immune system and also may help keep our cells from going awry. There are hundreds of evidence-based clinical studies taunting the benefits of exercise for reducing risk of cancer recurrence as Andrea will outline in her course.

True compassion comes out of understanding and knowledge. Andrea has done an excellent job in the compilation of a comprehensive course with a strong working knowledge of anatomy and physiology, evaluating risk factors, health behaviors and social habits, conducting comprehensive fitness assessment so that an appropriate exercise program can be designed for a specific individual. She provides the necessary knowledge to helping you inspire and motivate your clients on healthier ways of "being" with modifications of negative habits and promoting positive lifestyle changes. The information of diagnosis, treatment, recovery and prevention of various cancers and the prevention of lymphedema is concise, accurate and current.

Having taken her course recently myself, I strongly endorse Andrea's passion for and approach to teaching skilled, competent and compassionate Cancer Exercise Specialists. We have millions of people in both active treatment and survivorship that would benefit from a Cancer Exercise Specialist. I wish you the best on this wonderful education experience and applaud you for your passion to help others.

With hope and healing,
Cynthia Aks, DO FACOS, ABIHM

BIOGRAPHY

Andrea Leonard earned her BA from the University of MD in 1990 and currently enrolled in an MS program for Functional Nutrition at Rocky Mountain University of Health Professions. She is the PFP Club Industry 2019 Personal Trainer of the Year and the Chairman of the Board for the MedFit Network. She has been certified as a Conditioning Specialist by the National Sports Professionals Association (NSPA), Personal Trainer by the American Council on Exercise (ACE), Health and Fitness Instructor by the American College of Sports Medicine (ACSM), Optimum Performance Trainer, Performance Enhancement Specialist and Corrective Exercise Specialist by the National Academy of Sports Medicine (NASM), and as a Special Populations Expert by The Cooper Institute.
Andrea is also a continuing education provider for AAHF, ACE, AFAA, CanFitPro, FAI, ISSA, NASM, NFPT, PTAG, YMCA, and Yoga Alliance.

A cancer survivor herself at age eighteen, Andrea watched her mother struggle through two breast cancer diagnoses over the course of twenty years. Watching the pain and suffering that her mother needlessly endured, "frozen shoulder," narcotics addiction – due to chronic pain from an axillary node dissection, negative postural deviations from bi-lateral mastectomies and attempted reconstruction, staph infections, osteoporosis, etc. Andrea was bound and determined to help the millions of cancer survivors out there looking for answers on how to take back control of their life.

Andrea, along with a team of medical professionals from Georgetown University Hospital, Johns Hopkins Medical Center, and The George Washington Medical Center, spent three years working on her first book, "Essential Exercises for Breast Cancer Survivors.

Wanting to spread her knowledge about exercise, and the important role it plays in cancer breast cancer recovery, Andrea founded the Breast Cancer Survivor's Foundatio (an Oregon-based 501-C3 corporation0 in 2001. In 2004, after her father's diagnosis of bladder and prostate cancer, she realized that there was an even greater need to help people suffering through many different types of cancaer and she founded the Cancer Exercise Training Institute. In 2004 the first edition of the "Cancer and Exercise Specialist Handbook," was written. Andrea developed a curriculum for health and fitness professionals and began teaching live and virtual workshops to spread the gospel to others. Andrea has trained over 12,000 Cancer Exercise Specialists in 40 countries and continues to develop and expand course offerings to maintain CETI's gold standard of education in the health and fitness industry. In 2019/2020, CETI opened affiliate programs in Asia, Australia, Europe, the Middle East, and New Zealand.

Andrea has been a guest speaker for several international and national fitness organizations, including IDEA World, Functional Aging Summit, Medical Fitness Tour, TSI -Town Sports International Summit, Northwest Strength & Conditioning Clinic, Medical Fitness Association Annual Conference, and IHRSA – International Health, Racquet, & Sports club Association Annual Conference, as well as appearing regularly on AM Northwest. Andrea has been interviewed by The Oregonian, The Portland Tribune, The Lake Oswego Review, The West Linn Tidings, The Washington Post, The LA Times, The Dallas Morning News, The New York Times, NASM Training Edge Magazine, Capital Style Magazine, Heal Magazine, Club Solutions Magazine, The Examiner, Club Industry, PFP Magazine and more. When she is not on the road Andrea lives in Portland, Oregon with her husband and three children. You can learn more information about The Cancer Exercise Training Institute at www.thecancerspecialist.com

CHAPTER ONE

THE EXERCISE PROGRAM

PROGRAM OVERVIEW

The exercises in this book are organized according to need and difficulty. The first section includes exercises that will help address range of motion and postural deviations that may have been the result of breast cancer surgery and/or treatment. The other sections contain the core, balance, and strength training exercises that make up the ***breast cancer recovery*** program.

All of the exercises in this book are performed on the BOSU® Balance Trainer. The term "BOSU" means "Both Sides Utilized." BOSU® balance training is about movement, reshaping and strengthening the body, and simultaneously strengthening the mind. This is the reason I have chosen the BOSU® Balance Trainer as the focus of the workout program. It doesn't matter if you're facing the toughest competition of your athletic career, or of your life - i.e.; breast cancer. The Breast Cancer Recovery with the BOSU® Balance Trainer program will help your clients to safely and effectively take control of both their mind and their body at a time when they may feel that they have lost all control. The program will instruct you how to take them through all of the steps to help them get back to their previous level of fitness, or in some cases, reach new heights in strength, flexibility, and overall athletic performance.

WHY THE BOSU® BALANCE TRAINER?

One of the most important, if not ***THE*** most important part of recovery from the debilitating side- effects of breast cancer surgery and treatment is correcting postural deviations that are the result of muscle imbalances. We must re-educate the body to restore its' normal balance. Most of us think of balance as one's ability to stand without falling, but it actually represents the ability to stabilize and maintain a specific body position. Postural control is defined as the act of maintaining, achieving, or restoring a state of balance during any posture or activity. Therefore, it only makes sense that performing exercises to correct range of motion and postural deviations, while incorporating the aspect of balance, would yield the greatest results!

As individuals, we all have varying levels of ***kinesthetic awareness: sensitivity to the moment of your body through space that contributes to your ability to balance and move rhythmically and fluidly.*** This can be affected by many things; age, previous injuries, athleticism, and neuropathy.

A fairly common side-effect of chemotherapy is peripheral neuropathy. Peripheral nerves carry information to and from the brain and carry signals to and from the spinal cord to the rest of the body. Peripheral neuropathy means these nerves don't work properly. Peripheral neuropathy may be damage to a single nerve, or a group of nerves. Typical symptoms of neuropathy are related to the type of affected nerve. If a sensory nerve is damaged, common symptoms include numbness, tingling in the area, a prickling sensation, or pain. Pain associated with neuropathy can range from a mild burning to an intense stabbing sensation. In some cases, a non-painful stimulus may be perceived as excruciating or pain may be felt even in the absence of a stimulus. Damage to a motor nerve is usually indicated by weakness in the affected area. If the problem with the motor nerve has continued over a length of time, muscle shrinkage, or lack of muscle tone may be noticeable.

This brings us to another very important aspect of balance and ***performance, proprioception. Proprioception is the ability to sense the position, location, orientation, and movement of the body and its parts.*** You can see how this could become challenging to someone who is affected by peripheral neuropathy and either loses sensation in their extremities or is fraught with constant pain in that area. If your client has peripheral neuropathy in their hands, they may find it very difficult to articulate exercises that involve the use of weights or resistance bands. You can avoid those exercises and focus on the many exercises that do not require an external load to be placed on the muscles.

If they have peripheral neuropathy in their feet, it is not advisable to perform high impact activities. That being the case, when bouncing on the BOSU® Balance Trainer, make sure that their feet remain in contact with the dome and instruct them to stop if their pain increases; or they feel unsteady due to lack of sensation in their feet. Peripheral neuropathy may be temporary or, in some cases, chronic. Your client should listen to their body and respect whatever limitations it may place on them in a given day. Remember that you can still advance and help them work towards both their short-term and long-term personal fitness goals.

Exercising on the BOSU® Balance Trainer is going to help them to increase their ***postural stability; their ability to maintain the position of their body, or more specifically, it's' center of mass, within specific boundaries of space.*** This, too, is one of the many benefits of working on the BOSU® Balance Trainer. Many of your clients may be menopausal either from the natural aging process, or, from the early onset of menopause due to their breast cancer treatment(s). This will result in the cessation of estrogen production which increases their risk of ***osteoporosis; reduction in bone mineral density.*** Not only will they increase their bone density by performing many of the weight-bearing exercises in this handbook, they will be constantly working on their balance and core stability which will dramatically reduce their risk of falling! Additionally, they will be strengthening the tendons and ligaments that are a vital part of ankle stabilization.

In summary, exercising on the BOSU® Balance Trainer is going to have some, if not all, of the following benefits:

- Increase kinesthetic awareness, proprioception, and postural stability
- Increase bone density/reduce the risk of osteoporosis
- Increase balance/minimize your risk of falling and breaking a bone

- Strengthen ligaments and tendons of ankle complex/ reduce risk of sprains and strains
- Increase aerobic capacity
- Increase lymphatic drainage (by gently bouncing on the BOSU® Balance Trainer)
- Increase core strength/minimize low back pain
- Correct postural deviations/reduce pain and joint degeneration
- Increase range of motion
- Improve functional fitness and the ability to perform activities of daily living

FUNCTIONAL FITNESS ON THE BOSU® BALANCE TRAINER

In order to help your client improve their "functional fitness," one must first understand what that means to each individual. As fitness professionals we have been taught that functional fitness is a sport-specific term; our goal has been to mimic movements required for a particular sport (throwing a baseball, swinging a tennis racquet or golf club, shooting a basketball, etc).

Functional fitness in laymen's terms is the ability to perform activities of daily living with relative ease, or, to mimic movements that a person will encounter in their day-to-day life. This may be the act of squatting (in order to get in and out of a chair or to lower/lift an object safely), shoulder flexion (in order to reach for something on a high shelf), triceps flexion/extension (in order to push oneself up from a chair or out of bed), etc. When considering functional training, our goal is to move away from exercises that ***only*** focus on a ***single joint.*** Instead our goal becomes integrating the ***entire body*** so that all of the muscles work together synergistically. Part of this equation is, of course, the integration of balance and coordination as well as general body awareness (kinesthetic awareness).

When we introduce these aspects of training to our clients, we instruct them on how to manage their own body weight in establishing their center of gravity. This may sound like an easy task for those of us who have not been faced with any considerable physical challenges. To the elderly, or anyone recovering from surgery or an injury, it is a matter of re-establishing what was once second-nature to that individual.

As fitness professionals, our goal is to help them create safe and efficient movements by teaching them how to use their mind and their body synergistically in stabilizing their joints. Throughout the exercise program you will be helping your client to re-establish overall body stability and alignment and finding their center of gravity.

OPEN VS. CLOSED CHAIN EXERCISES ON THE BOSU® BALANCE TRAINER

There are a variety of open and closed chain exercises that you may be using in the Breast Cancer Recovery BOSU® program. This will help you determine whether you are using an isolated or compound movement. A closed chain exercise (CCE) occurs if either the arms or legs (hands or feet) are involved in supporting the body weight. In a lunge or a squat, the legs and feet bear the weight of the body. A push-up or plank that is performed using the BOSU® Balance Trainer, although only partially supporting the body weight, is also considered a CCE.

An open chain exercise (OCE) is an isolated movement, whereas a CCE is a compound movement that is dynamic in nature and works the body as a whole. An OCE occurs when the arms or legs (hand and feet) are not fixed and are not supporting the weight of the body. An example of this would be seated (upright) reverse fly with a band or unilateral chest fly.

Although it is important to strengthen specific muscle groups in isolation, particularly when we are trying to correct muscles imbalances, it is equally important to combine muscle groups and various movement patterns.

MULTIPLE PLANE MOVEMENT ON THE BOSU® BALANCE TRAINER

Functional (every day) movement occurs in multiple planes. Functional movement takes place in the transverse, sagittal, and frontal planes (refer to the chart on page 88). In the ***transverse plane,*** movement divides the body into top and bottom halves, in the ***sagittal plane,*** movement divides the body into right and left halves, and in the ***frontal plane,*** movement divides the body into front and back halves. The shoulder flexion, balance, and core series (pages 173-175) is a perfect example of a multiple plane routine.

BALANCING ON THE BOSU® BALANCE TRAINER

In order to maintain postural stability, one must be able to maintain their center of gravity within specific stability and balance limits. This skill cannot be developed without training the neuromuscular system. This requires practice, training, and experience; all of which have been compromised following cancer surgery and treatment. No matter how fit or athletic your client was prior to their diagnosis, they are starting from ground zero in the aftermath of treatment.

The nervous system is the control center for communication and directs movement throughout the body. Cancer treatment can have temporary or permanent side-effects on the nervous system. Nervous system side effects are common from cancer and cancer treatments. The nervous system is made up of the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS is made up of the brain and spinal cord. The PNS is made up of the nerves outside of the CNS that carry information back and forth between the body and the brain. The PNS is involved in movement, sensing (touching, hearing, seeing, tasting, and smelling), and the functioning of the internal organs, (for example, the stomach, lungs, and heart).

Some of the nervous system side effects that may be caused by cancer or cancer treatment include the following:

- Hearing loss and/or tinnitus (ringing in the ears)
- Vision loss and/or vision side effects (such as blurred or double vision)
- Speech difficulties, such as slurred speech, difficulty expressing oneself or understanding speech
- Cognitive (thought process) changes including decreased memory, problem solving, and calculation
- Changes in taste and smell
- Difficulty swallowing
- Problems with balance, dizziness, vertigo (feeling like the room is spinning), and nausea
- Ataxia (problems with coordination) and movement, including problems with posture, walking, or holding objects
- Asthenia, a general weakness that causes an overall lack of strength; hemiparesis (weakness on one side of the body); drowsiness
- Paralysis of different parts of the body, ranging from hemiplegia (paralysis of one side of the body) to paralysis of a smaller area, such as the muscles in the face
- Seizures
- Changes in the functioning of organs, which can cause constipation, incontinence (inability to control the flow of urine), and impotence (an inability to get or maintain an erection)
- Pain which can be caused by a tumor pressing on the nerves or damage to the nerves from treatment
- Peripheral neuropathy which is a condition caused by damage or irritation to the peripheral nerves. The symptoms may include numbness, tingling (“pins and needles”), or burning pain in the arms, hands, legs, or feet; decreased ability to sense hot and cold; difficulty lifting the feet or toes; difficulty picking up small objects; decreased muscle strength; vision or hearing changes; and/or constipation.

Nervous system side effects are caused by many factors, including cancer, cancer treatments, other medications, or other disorders. The symptoms may appear soon after treatment or may appear several years after treatment.

Possible causes of nervous system problems:

- Cancer that has metastasized (spread) to the brain or spinal cord
- Tumors growing in other parts of the body that press on nerves
- Some types of chemotherapy may cause peripheral neuropathy
- Radiation therapy
- Surgery, if nerves are damaged during surgery to remove a tumor or to perform a biopsy
- Specific medications, including some anti-nausea drugs, opioid pain killers, and anticonvulsants
- Infections causing swelling or inflammation of the brain, spinal cord, or inner ear
- Other conditions or symptoms related to cancer or cancer treatments, including anemia (low number of red blood cells), dehydration, fatigue, stress, and depression
- Other conditions or disorders not related to cancer, such as diabetes, vitamin deficiency, thyroid dysfunction, human immunodeficiency virus (HIV), stroke, Alzheimer's disease, multiple sclerosis, and nerve injury

If a muscle is not activated by the nervous system, it will not contribute to movement. I have seen this in clients whose breast cancer metastasized to their brain. They began to lose reflexes and strength in particular muscles/movements. This is sometimes the first indication that there is, in fact, a brain metastasis. If you notice that your client has lost motor control, calmly suggest that they see their attending physician without alarming them. ***Do not make a diagnosis, or even an educated guess!***

Because muscles need to learn how to contribute to movement patterns through ongoing training and repetition, the BOSU® Balance Trainer program is the perfect medium in which to do so. You can help your client to gradually and progressively learn how to control their muscular force output for any given movement. This begins with kinesthetic awareness that may need to be re-learned after treatment.

Be patient and don't get frustrated if they do not progress at a speed that you would have anticipated. Sometimes the best that we as fitness professionals can do is to minimize the loss of function. I have worked with clients in which there is no marked progress over time. I consider the fact that there is no ***decline*** in performance a success story for those people. Set realistic expectations when you are working with your clients. Be encouraging and optimistic, but also be a realist!

CHAPTER TWO

BREAST SURGERY AND RECONSTRUCTION

Objective: to understand the different types of breast surgery and reconstruction and the part they play in muscle imbalance and limited ROM.

- Which type of breast surgery was performed and when?
- Which type of reconstruction (if any) was performed and when?
- Did they undergo radiation; if so, when?
- Did they have lymph nodes removed?
- Identify and correct muscle imbalances and ROM limitations
- Understand the importance of weight management

Goal: to create a program using the proper combination of stretching, strengthening, and cardio that will be safe & effective; know how and when to progress/regress on a daily, weekly, or monthly basis.

BREAST CANCER

In 2020 there were 2,261,419 new cases of breast cancer and 684,996 deaths worldwide [1, 31]. Probably no disease is more dreaded by most women than breast cancer. It is the leading form of cancer among females and carries with it fear of death as well as deformity. It is the leading cause of cancer death for women and the fifth leading-cause of cancer mortality worldwide [1, 31]. One of the underlying reasons for the increasing number of breast cancer diagnoses may be ongoing changes in relevant risk factors for breast cancer, including later-in-life childbearing and having fewer children. These changes can be seen most in countries that are undergoing major societal and economic change. An increase in levels of excess body weight and physical inactivity also contribute to the rising numbers of breast cancer cases worldwide [31]. The risk of developing breast cancer increases as you get older. About 1 out of 8 invasive breast cancers are found in women younger than 45, while about 2 of 3 invasive breast cancers are found in women age 55 or older [1].

About 5% to 10% of breast cancer cases are thought to be hereditary, meaning that they result directly from gene defects (called mutations) inherited from a parent (see genetics chapter) [3]. Breast cancer risk is higher among women whose close blood relatives have this disease; having one first-degree relative (mother, sister, or daughter) with breast cancer may double a woman's risk. Having two first-degree relatives increases her risk about three-fold [2]. The exact risk is not known, but women with a family history of breast cancer in a father or brother also have an increased risk of breast cancer [2]. According to the American Cancer Society, a woman with cancer in one breast has a three-to-four-fold increased risk of developing a new cancer in the other breast or in another part of the same breast [2]. This is different from a recurrence (return) of the first cancer. Women who started menstruating early (before age 12) and/or went through menopause later (after age 55) have a slightly higher risk of breast cancer; possibly due to a longer lifetime exposure to the hormones - estrogen and progesterone [2]. Women who have had no children or who had their first child after age 30 have a slightly higher breast cancer risk overall [2]. Having many pregnancies and becoming pregnant at a young age reduce breast cancer risk overall [2]. Studies have shown that using combined hormone therapy after menopause increases the risk of getting breast cancer. It may also increase the chances of dying from breast cancer [2]. *The use of estrogen alone after menopause does not appear to increase the risk of developing breast cancer [2].*

Study after study continues to show that physical activity/exercise reduces breast cancer risk. In one study from the Women's Health Initiative, as little as 1.25 to 2.5 hours per week of brisk walking reduced a woman's risk by 18% [4].

Fortunately, through early detection, the incidence of mortality among women with breast cancer has been on a steady decline. Most tumors are detected when they are still localized to the breast, allowing for breast conserving surgery instead of a mastectomy. Overall, 61% of breast cancer cases are diagnosed at a localized stage (no spread to lymph nodes or outside of the breast), and the five-year survival rate is 99%, according to the American Cancer Society [2].

TYPES OF BREAST CANCER

- **Paget's disease -** is a rare type of breast cancer that occurs in the ducts adjacent to the nipple and areola and spreads to the skin of the nipple and the areola. Accounting for only one percent of breast cancers, it is a rare presentation. Paget's disease is usually associated with ductal carcinoma in situ (DCIS) and is limited to the nipple and areola area of the breast. It accounts for only 1-4% of all breast cancer cases [23].

  Paget's disease is almost always associated with either ductal carcinoma in situ (DCIS) or infiltrating ductal carcinoma. Treatment often requires mastectomy. If no lump can be felt in the breast tissue, and the biopsy shows DCIS but no invasive cancer, the prognosis is excellent. If invasive cancer is present, the prognosis is not as good, and the cancer will need to be staged and treated like any other invasive cancer.

Symptoms of Paget's disease include:

- Redness and irritation of the nipple and/or areola
- Crusting and scaling of the nipple area
- Bleeding from the nipple/areola
- Oozing from the nipple/areola
- Burning and/or itching of the nipple/areola

- **Phyllodes tumors -** are most common in women in their 40s, but women of any age can have them [238]. Women with Li-Fraumeni syndrome (a rare, inherited genetic condition) have an increased risk for phyllodes tumors [238]. These tumors are usually benign, but about 25 percent are malignant [238]. These tumors are a form of sarcoma because they grow in the connective tissue of the breast, not in the ducts.

  Benign phyllodes tumors are treated by removing the tumor along with a margin of normal breast tissue. A boderline (somewhere between benign and malignant) or malignant phyllodes tumor is treated by removing it along with a wider margin of normal tissue, or by mastectomy. Surgery is often all that is needed, but these cancers might not respond as well to the other treatments used for more common breast cancers. When a malignant phyllodes tumor has spread, it can be treated with the chemotherapy given for soft-tissue sarcomas.

Symptoms of Phyllodes tumors include:

- Smooth, hard lump felt beneath the skin
- Sometimes it can be seen as a smooth bulge
- They can be fast growing and become very large

- **Ductal Carcinoma in Situ (DCIS) –** is non-invasive breast cancer that hasn't spread beyond the milk duct into any normal surrounding breast tissue. DCIS isn't life-threatening but having DCIS can increase the risk of developing an invasive breast cancer later. When a woman has DCIS, they are at higher risk for the cancer coming back or for developing a new breast cancer than a woman who has never had breast cancer before. Most recurrences happen within the 5 to 10 years after initial diagnosis. The chances of a recurrence are under 30%. Women who have breast-conserving surgery (lumpectomy) for DCIS without radiation therapy have about a 25% to 30% chance of having a recurrence at some point in the future [32]. Including radiation therapy in the treatment plan after surgery drops the risk of recurrence to about 15% [32].

Symptoms of DCIS include:

- Smooth lump found beneath the skin
- Discharge coming from nipple

- **Invasive Ductal Carcinoma (IDC) -** is cancer that began growing in the duct and has invaded the fatty tissue of the breast outside of the duct. It is the most common form of breast cancer, representing 80 percent of all breast cancer diagnoses [23]. There are four types of invasive ductal carcinoma that are less common:
  - **Medullary Ductal Carcinoma –** this type of cancer is rare and accounts for about 3-5% of all breast cancers [23]. The tumor usually shows up on a mammogram and it does not always feel like a lump; rather it can feel like a spongy change of breast tissue.
  - **Mucinous Ductal Carcinoma –** is sometimes called colloid carcinoma and is a rare form of IDC. Only about 2-3% of invasive breast cancers are "pure" mucinous carcinomas [23]. Although mucinous carcinoma can be diagnosed at any age, it tends to affect women after they've gone through menopause. Some studies have found that the average age at diagnosis is in the 60's or early 70's [23].
  - **Papillary Carcinoma –** this type of cancer is rare and accounts for only 2% of all breast cancers[23]. this is a very good prognosis breast cancer that primarily occurs in women over the age of 60 [23]. Most papillary carcinomas are invasive and are treated like invasive ductal carcinoma. However, invasive papillary carcinoma typically has a better prognosis than other invasive breast cancers.
  - **Tubular Ductal Carcinoma –** this type of cancer is rare and accounts for only 2% of all breast cancers[23]. The name comes from how the cancer looks under the microscope; like hundreds of tiny tubes. Typically it is found in women aged 50 and above and usually responds well to hormone therapy [23].

Symptoms of IDC include:

- Lump in the breast
- Thickening of the breast skin
- Rash or redness of the breast
- Swelling in one breast
- New pain in one location of the breast
- Nipple pain or the nipple turning inward
- Nipple discharge
- Dimpling around the nipple or on the skin
- Lumps in the underarm

- **Lobular Carcinoma In Situ (LCIS) -** is an area(s) of abnormal cell growth that began growing in the lobules and increases a woman's risk of developing invasive breast cancer later in life. Although its name includes the term "carcinoma," LCIS is not a true breast cancer; it is an indication that a person is at higher-than-average risk for getting breast cancer at some point in their life. LCIS is usually diagnosed before menopause, most often between the ages of 40 and 50 [21]. Less than 10% of women diagnosed with LCIS have already gone through menopause [33]. LCIS is extremely uncommon in men. In more than half of cases, LCIS is "multifocal," meaning that multiple lobules have areas of abnormal cell growth inside them. In about one-third of women with LCIS, the other breast is affected as well [33].

Symptoms of LCIS include:

- Microcalcifications that show up on mammogram

- **Invasive Lobular Carcinoma (ILC) -** is the second most common form of breast cancer after invasive ductal carcinoma [24]. This type of cancer is more difficult to see on imaging because of the way it grows with spreading branches. Over time, invasive lobular carcinoma can spread to the lymph nodes and possibly to other areas of the body. It tends to be more difficult to see on mammograms than invasive ductal carcinomas are because the cancer cells typically spread to the surrounding connective tissue (stroma) in a line formation as opposed to a palpable lump. Although invasive lobular carcinoma can affect women at any age, it is more common as women grow older. According to the American Cancer Society, about two-thirds of women are 55 or older when they are diagnosed with an invasive breast cancer [21]. ILC tends to occur later in life than invasive ductal carcinoma - the early 60's as opposed to the mid- to late 50's [21]. Some research has suggested that the use of hormone replacement therapy during and after menopause can increase the risk of ILC [22].

Symptoms of ILC include:

- Thickening or hardening of the breast that can be felt
- An area of fullness or swelling
- A change in the texture of the skin
- The nipple turning inward

- **Invasive Mammary Carcinoma (IMC) -** is also known as infiltrating mammary carcinoma, and is a mixture of invasive ductal and lobular carcinomas.

  Symptoms of IMC include:

  - Lump in the breast
  - Thickening of the breast skin
  - Rash or redness of the breast
  - Swelling in one breast
  - New pain in one breast
  - Dimpling around the nipple or on the breast skin
  - Nipple pain or the nipple turning inward
  - Nipple discharge
  - Lumps in the underarm area
  - Changes in the appearance of the nipple or breast that are different from the normal monthly changes

- **Inflammatory Breast Cancer -** is an aggressive and fast-growing cancer that accounts for 1-5% of all breast cancers [23]. In the past, it commonly was misdiagnosed as mastitis or dermatitis because it can look like a breast infection or a rash on the skin of the breast. Inflammatory breast cancer doesn't commonly form a lump, as occurs with other forms of breast cancer. Inflammatory breast cancer occurs when cancer cells block the lymphatic vessels in skin covering the breast, causing the characteristic red, swollen appearance of the breast. Inflammatory breast cancer is considered a locally advanced cancer; it has spread from its point of origin to nearby tissue and possibly to nearby lymph nodes.

  Symptoms of Inflammatory Breast Cancer include:

  - Rapid change in the appearance of one breast, over the course of several weeks
  - Thickness, heaviness or visible enlargement of one breast
  - Discoloration, giving the breast a red, purple, pink or bruised appearance
  - Unusual warmth of the affected breast
  - Dimpling or ridges on the skin of the affected breast, like an orange peel
  - Tenderness, pain or aching
  - Enlarged lymph nodes under the arm, above the collarbone or below the collarbone
  - Flattening or turning inward of the nipple

- **Metaplastic Breast Cancer -** is a very rare form of breast cancer. It is relatively uncommon, making up less than 1% of all breast cancers [21]. The disease is aggressive and usually has a triple-negative receptor type. It is difficult to treat successfully.

- **Metastatic Breast Cancer -** is cancer that has spread to other organs in the body, also classified as stage IV breast cancer.

- **Angiosarcoma -** sarcomas of the breast are rare making up less than 1% of all breast cancers [21]. Angiosarcoma starts in cells that line blood vessels or lymph vessels. It can involve the breast tissue or the skin of the breast. Some cases may be related to radiation therapy in the affected area.

Breast cancers are classified as follows:

Early Breast Cancers

- **Stage 0 Breast Cancer –** this is noninvasive breast cancer, or carcinoma in situ. Cancer cells are limited to the lining of the ducts and have not spread beyond the duct. There are three types of stage 0 breast cancer:

  - DCIS - ductal carcinoma in situ
  - LCIS - lobular carcinoma in situ
  - Paget disease

- **Stage I (A/B) Breast Cancer –** the cancer has spread from the ducts or lobules into the nearby fatty tissue of the breast. In stage IA, the tumor diameter is less than 2 centimeters and there is no cancer in the lymph nodes.

  In stage 1B either no visible tumor is found, or it is less than 2.5 centimeters. There is evidence of cancer in the lymph nodes with small clusters of cells between .2mm to 2.0 mm.

- **Stage II (A/B) Breast Cancer –** in stage IIA either no visible tumor is found and there is cancer in fewer than four axillary lymph nodes, or the tumor diameter is less than 2 centimeters and there is cancer in fewer than four axillary lymph nodes. Lastly, it may be between 2-5 centimeters with no sign of cancer in the lymph nodes.

  In stage IIB the tumor is between 2-5 centimeters and there is cancer in fewer than four axillary lymph nodes, or the tumor is greater than 5 centimeters with no sign of cancer in the lymph nodes.

Advanced Breast Cancers

- **Stage III (A, B, and C) Breast Cancer –** in stage IIIA, either no actual tumor is associated with the cancerous cells or the tumor may be any size, 4-9 nearby lymph nodes contain cancer. Alternatively, the tumor can be more than 5 centimeters, and there is evidence of cancer in the lymph nodes with small clusters of cells between .2mm to 2.0 mm. Lastly, the tumor may be over 5 centimeters and the cancer has spread to 1-3 lymph nodes in the armpit or near the breastbone.

  In stage IIIB, the tumor may be any size, and the cancer has invaded the chest wall or breast skin with evidence of swelling, inflammation, or ulcers. There is evidence of cancer in up to 9 nearby lymph nodes.

  In stage IIIC, either no actual tumor is associated with the cancerous cells, or the tumor may be any size with cancer having invaded the chest wall or breast skin with evidence of swelling, inflammation, or ulcers and evidence of cancer 10 or more lymph nodes under the arm. Alternatively, no actual tumor is associated with the cancerous cells, or the tumor may be any size and there is evidence of cancer in the lymph nodes extending to the collarbone area. Lastly, no actual tumor is associated with the cancerous cells or the tumor may be any size and there is evidence of cancer in the lymph nodes under the arm and near the breastbone.

Other considerations:

- **Stage IV/Metastatic Breast Cancer –** the cancer has spread from the breast and lymph nodes to other parts of the body; there are usually organs involved, including the lungs, liver, bones and/or brain.
- **Grade –** is an evaluation of how abnormal or disorganized the cells appear when examined under a microscope. In general, a lower grade implies a less aggressive tumor.
- **Lymphovascular or Perineural Invasion –** sometimes tumor cells can invade the blood vessels, or the lymph or nerve channels within breast tissue.
- **Gene Expression Profiling –** oncotype DX® is a test that is used to analyze the expression pattern of 21 genes in clients with a breast tumor that is estrogen-receptor positive and axillary-lymph-node-negative.

The pattern is translated into a recurrence "score" that attempts to predict which women will benefit most from reatment with chemotherapy in addition to hormonal therapy, and which women might be safely spared chemotherapy. This treatment with chemotherapy in addition to hormonal therapy, and which women might be safely spared chemotherapy. This test is part of a novel and increasingly popular approach called "personalized medicine" for cancer, in which the molecular features of the specific tumor are analyzed to determine optimal treatment for everyone.

There are three major receptor subtypes that play important roles in the patient's prognosis and treatment:

- **Hormone Receptor Status –** receptors are molecules that cancer cells produce on their surface. These receptors can interact or bind with specific proteins and hormones in the patient's body. By interrupting this recognition with new cancer drugs, the disease's growth can be slowed or stopped. Breast cancer cells that have receptors for the hormones estrogen and/or progesterone are called estrogen receptor (ER) and/or progesterone receptor (PR) positive. If these receptors are not present, the cell is said to be receptor-negative. Approximately 80% of newly diagnosed breast cancers are ER+ although this proportion varies with age at diagnosis and ethnicity [286]. Tumors that are receptor-positive are more likely to respond to therapy with anti-estrogen medications which take advantage of the cancer cell's dependence on hormones for growth.
- **HER2/neu Status –** HER-2/neu is a protein that promotes cell growth and multiplication. About half of HER2-positive cancers are also hormone receptor-positive/ER positive. Tumors that have more than normal amounts of this protein (HER2-positive) may benefit from the drug trastuzumab (Herceptin®), which blocks the growth of tumors activated by the gene, or a similar drug called lapatinib (Tykerb®).
- **Triple Negative Breast Cancer (TNBC) –** a diagnosis of triple negative breast cancer means that the three most common types of receptors known to fuel most breast cancer growth (estrogen, progesterone, and the HER-2/neu gene) are absent in the cancer tumor. This means that the breast cancer cells have tested negative for hormone epidermal growth factor receptor 2 (HER-2), estrogen receptors (ER), and progesterone receptors (PR). Unfortunately, since the tumor cells are missing the necessary receptors, common treatments such as hormone therapy and drugs that target estrogen, progesterone, and HER-2 are ineffective. Using chemotherapy to treat triple negative breast cancer is an effective option.

Triple negative breast cancer may respond even better to chemotherapy in the earlier stages than many other forms of cancer [25,26,34]. TNBCs tend to occur in younger women and African-American women and account for about 15% of all breast cancers [25,26,34].

MALE BREAST CANCER

Male breast cancer is a disease in which malignant (cancer) cells form in the tissues of the breast. Men at any age may develop breast cancer, but it is usually detected in men between 60 and 70 years of age. Male breast cancer makes up less than 1% of all cases of breast cancer.

Lobular carcinoma in situ (abnormal cells found in one of the lobes or sections of the breast), which sometimes occurs in women, has not been seen in men. The following types of breast cancer are found in men:

- **Infiltrating ductal carcinoma:** cancer that has spread beyond the cells lining ducts in the breast. Most men with breast cancer have this type of cancer.
- **Ductal carcinoma in situ:** abnormal cells that are found in the lining of a duct; also called intraductal carcinoma.
- **Inflammatory breast cancer:** a type of cancer in which the breast looks red and swollen and feels warm.
- **Paget disease of the nipple:** a tumor that has grown from ducts beneath the nipple onto the surface of the nipple.

Lobular carcinoma in situ (abnormal cells found in one of the lobes or sections of the breast), which sometimes occurs in women, has not been seen in men. Men may have the same genetic risk factors as women.

Survival rate for men with breast cancer is similar to that for women; when their stage at diagnosis is the same. Breast cancer in men, however, is often found at a later stage, and as a result, may be less likely to be cured.

Symptoms of Inflammatory Breast Cancer include:

- Thickening or hardening of the breast that can be felt
- Discharge from the nipple
- A change in the texture of the skin
- The nipple turning inward

FACTORS THAT MAY AFFECT YOUR RISK OF GETTING BREAST CANCER

Genetics – only about 5-10% of breast cancers are thought to be hereditary [3]. They are caused by abnormal genes that are passed from parent to child. Genes are made of DNA (deoxyribonucleic acid). DNA contains the "instruction manual" for building the proteins that control the structure and function of all the cells in the human body. Abnormalities in the DNA may provide faulty instructions, leading to improper cell growth and/or function.

- **PALB2 genes –** brand new research is telling us that the PALB2 gene abnormality raises the risk of breast cancer 8-9 times as high among those younger than 40 years of age, 6-8 times as high among those 40-60 years of age, and 5 times as high among those older than 60 years of age [6]. The PALB2 is also shown to be a factor in male breast cancer [6]. Research has concluded that the risk of developing breast cancer is significantly higher, even where there is no family history of breast cancer for those carrying the PALB2 mutation [6]. For women carrying the BRCA 1 & 2 genetic mutations the risk of developing breast cancer by age 70 is 45-65% according to the National Cancer Institute [5]. For women carrying the PALB2 genetic mutation the risk of developing breast cancer by age 70 is 33%. According to William Foulkes, director of the Program in Cancer Genetics at McGill University's Center for Translational Research in Cancer, Montreal, Canada researcher into PALB2, 1/1000 women carry the genetic mutation [7]. Research is also showing an increased risk of pancreatic cancer and ovarian cancer with the PALB2 mutation [7]. Genetic screening for PALB2 is proving to be merited increasingly with ongoing research.
- **Hereditary Breast and Ovarian Cancer Syndrome –** for many years, doctors have studied families in which many of the women developed breast and or ovarian cancer. Often the cancers were found at younger than usual ages, and some of the women had multiple cancers. Some had bi-lateral breast cancer while some had breast and ovarian cancer. The term that is used to describe them is Hereditary Breast and Ovarian Cancer Syndrome (HBOC). Scientists who studied the genes of these families, discovered the genes BRCA1 and BRCA2. Because some women (and families) have HBOC based on cancer history, but don't have mutations in these genes, scientists believe that there must be at least one more gene that may cause HBOC. This had been named BRCA3 but has not yet been identified.

- **BRCA1 or BRCA2 -** can lead to HBOC. The risk of breast and ovarian cancer is very high when there are mutations in either gene but seems to be higher with BRCA1 mutations [5, 39, 40, 43]. Along with breast and ovarian cancer, this syndrome can also lead to fallopian tube cancer, primary peritoneal cancer, male breast cancer, pancreatic cancer, prostate cancer, as well as some others [5]. Male breast cancer, pancreatic cancer, and prostate cancer can be seen with mutations in either gene but are more common in people with BRCA2 mutations [5, 39, 40, 43]. In the United States, mutations in the BRCA genes are more common in people of Ashkenazi Jewish descent [5].

  Women with a strong family history of breast cancer and/or ovarian cancer may choose to undergo genetic counseling to estimate their risk for having a mutation in one of the BRCA genes. The genetics professional estimates the risk based on the patient, as well as their family history of cancer. If they seem to be at high risk, they may recommend genetic testing. While the average lifetime risk of breast cancer for woman in the United States is about a 1 in 8 chance, women who have an abnormal BRCA1 or BRCA2 gene (or both) can have up to an 80% risk of being diagnosed with breast cancer during their lifetimes [3, 39, 43]. Breast cancers associated with an abnormal BRCA1 or BRCA2 gene are more likely to occur in younger women and, when they do occur, there is an increased risk of it occurring in both breasts [39, 40].

  Women with an abnormal BRCA1 or BRCA2 gene also have an increased risk of developing ovarian, colon, pancreatic, and thyroid cancers, as well as melanoma [3, 40, 41]. Women may consult with their gynecologist or breast surgeon to determine if they are considered high risk, and if they might benefit from genetic testing. Some women are not emotionally prepared to deal with the decisions surrounding genetic testing.

  A genetic counselor can inform them of the risks associated with testing either positive or negative for a BRCA gene mutation. Even presented with a negative test result, it does not eliminate the chance of developing breast cancer during a lifetime. In many cases someone may have a strong family history of breast cancer but may still test negative for both BRCA gene mutations. Unfortunately, there are the non-medical issues associated with testing positive for a BRCA gene mutation that also need to be considered. Health insurance carriers in the United States are prohibited from discriminating against patients that test positive for a BRCA gene mutation. Life insurance carriers, however, are not.

  Men who carry the BRCA mutation have a higher risk for breast cancer than men in the general population, however, the risk is still quite low [5]. The lifetime risk for breast cancer in men with the BRCA1 mutation is about 2% and about 8% in men with the BRCA 2 mutation [5]. The male breast cancer risk in the general population is about 1/1000, or 0.1%. The percentage of men with the BRCA mutation is higher among those of Ashkenazi Jewish decent [5]. Men who have an abnormal BRCA2 gene are also 7 times more likely than men without the gene to be diagnosed with prostate cancer [5].

  If someone in a family is found to have a BRCA mutation, it means that their close relatives (parents, siblings, and children) have a 50% chance of having a mutation, too [3, 5, 40, 43].

- **Li-Fraumeni Syndrome –** is a rare syndrome that can lead to the development of a number of: osteosarcoma, soft-tissue sarcomas, leukemia, brain & central nervous system cancers, cancer of the adrenal cortex, and breast cancer. The cancers most often occur in childhood, although breast cancer occurs in young adults.

  People with Li-Fraumeni can also be affected by more than one cancer in their lifetime. They also seem to be at higher risk of cancer from radiation therapy, and so doctors treating these patients may try to avoid giving them radiation when possible. This syndrome is most often caused by inherited mutations in the gene for p53 (TP53, a tumor suppressor gene). A normal gene for p53 stops the growth of abnormal cells. It can also be caused by mutations in a gene called CHEK2.

- **CHEK2 –** is a serine/threonine kinase which is activated upon DNA damage and is implicated in pathways that govern DNA repair, cell cycle arrest or apoptosis in response to the initial damage. Male carriers have a higher risk for prostate cancer, as CHEK2 overexpression decreases cell growth while its downregulation affects androgen receptor activity. The I157T variant is associated with other types of cancer, including breast , kidney, colon, and thyroid [287]. According to Schmidt et al, who compared different studies that included more than 40,000 patients, carriers of the CHEK2*1100delC allele have a higher risk of developing breast cancer; however, this risk is lower in higher age groups [287]. In addition, carriers acquire higher probability to develop estrogen receptor-positive breast cancer than noncarriers; however, there is no evidence that this risk is dependent on the status of progesterone receptor (PR) or human epidermal growth factor receptor 2 [287].

- **Hormone therapy treatments –** several strategies are used to treat hormone-sensitive breast cancer:

  - **Blocking ovarian function (ovarian ablation):** because the ovaries are the main source of estrogen in premenopausal women, estrogen levels in these women can be reduced by eliminating or suppressing ovarian function. Ovarian ablation can be done surgically in an operation to remove the ovaries or by treatment with radiation. The results are usually permanent.

  - **Suppression of ovarian function –** this is usually a temporary treatment with drugs called gonadotropin-releasing hormone (GnRH) agonists, which are also known as luteinizing hormone-releasing hormone (LH-RH) agonists. These medicines interfere with signals from the pituitary gland that stimulate the ovaries to produce estrogen. Examples of ovarian suppression drugs that have been approved by the FDA are goserelin (Zoladex®) and leuprolide (Lupron®).

  - **Blocking estrogen production –** aromatase inhibitors can be used to block the activity of an enzyme called aromatase, which the body uses to make estrogen in the ovaries and in other tissues. Aromatase inhibitors are primarily given to postmenopausal women because the ovaries in premenopausal women produce too much aromatase for the inhibitors to block effectively. These drugs may be used in premenopausal women if they are given simultaneously with a drug that suppresses ovarian function. Examples of aromatase inhibitors approved by the FDA are anastrozole (Arimidex®) andletrozole (Femara®), both of which temporarily inactivate aromatase, and exemestane (Aromasin®), which permanently inactivates the enzyme.

    Studies have shown that both exemestane and anastrozole can lower the risk of breast cancer in post-menopausal women who are at increased risk of the disease [35, 37]. In one study, taking exemestane for 3 years lowered the risk of breast cancer overall (invasive cancer plus ductal carcinoma in situ) by about half (47%) [19]. In another study, taking anastrozole for 5 years lowered the risk of breast cancer overall by about half (47%) [20].

  - **Blocking estrogen's effects –** several types of drugs interfere with estrogen's ability to stimulate the growth of breast cancer cells:

    - **Selective estrogen receptor modulators (SERMs)** bind to estrogen receptors, preventing estrogen from binding. Examples of SERMs approved by the FDA include aretamoxifen (Nolvadex®), raloxifene (Evista®), and toremifene (Fareston®). Tamoxifen has been used for more than 30 years to treat hormone receptor-positive breast cancer. Because SERMs bind to estrogen receptors, they can potentially not only block estrogen activity, but also mimic estrogen effects. Most SERMs behave as estrogen antagonists in some tissues and as estrogen agonists in other tissues. For example, tamoxifen blocks the effects of estrogen in breast tissue but acts like estrogen in the uterus and bone.

      As a result of these trials, both tamoxifen and raloxifene have been approved by the FDA to reduce the risk of developing breast cancer in women at high risk of the disease [36, 37]. Tamoxifen is approved for use regardless of menopausal status. Raloxifene is approved for use only in postmenopausal women.

    - **Other antiestrogen drugs,** such as fulvestrant (Faslodex®), work in a somewhat different way to block estrogen's effects. Like SERMs, fulvestrant attaches to the estrogen receptor and functions as an estrogen antagonist. Fulvestrant has no estrogen agonist effects; it is a pure antiestrogen. When fulvestrant binds to the estrogen receptor, the receptor is also destroyed.

- **Prophylactic (preventive) surgery –** is the removal of the healthy breasts and ovaries in someone with a high risk of developing breast cancer. This might be an option for some women with an abnormal BRCA1 or BRCA2 gene, family history of breast cancer, previous breast cancer in one breast, or radiation to the chest area between the ages of 10-30 to choose.

  Prophylactic breast surgery may be able to reduce a woman's risk of developing breast cancer by as much as 97% [38]. The surgery removes nearly all the breast tissue, so there are very few breast cells left behind that could potentially develop into a cancer.

Women with an abnormal BRCA1 or BRCA2 gene may reduce their risk of breast cancer by about 50% by having their ovaries removed prior to menopause [39, 46]. By removing the ovaries, the risk of breast cancer is reduced because the ovaries are no longer producing estrogen in a premenopausal woman's body [40, 44]. Removing the ovaries does not, however, reduce the risk of breast cancer in postmenopausal women because fat and muscle tissue are the main producers of estrogen in these women (not the ovaries). Prophylactic removal of both ovaries and fallopian tubes reduces the risk of ovarian cancer by about 50% in women at any age [30, 33, 39, 46, 47]. Even if a woman is eventually diagnosed with breast or ovarian cancer after prophylactic surgery, research has shown an improved survival rate in these women [48].

- **Alcohol consumption –** when alcohol is consumed in ***adolescent and early adult years***, it may be relevant to breast cancer development. Several epidemiologic studies have evaluated alcohol consumption across the life course in relation to breast cancer risk. The majority of these studies reported that recent drinking, but not drinking in early adult life, was significantly associated with breast cancer risk [239, 240,241]. However, case–control studies showed a significant increase in breast cancer risk associated with the early age at which women started to drink (<25 years) [242] and with alcohol consumption before age 30 years [243, 244] . Alcohol consumption before age 30 years was dose dependently associated with premenopausal breast cancer risk, with a 34% increase in risk for every 13 g/day (~1 drink/day) of intake, but not with postmenopausal breast cancer risk [245].

  Alcohol is considered by the International Agency for Research on Cancer to be causally related to breast cancer risk[231], with a 7–10% increase in risk for each 10 g (1 drink) alcohol consumed daily by adult women[232, 235]. Compared with other organs, breast appears to be more susceptible to carcinogenic effects of alcohol. As ***adults***, the risk of breast cancer is significantly increased by 4–15% for light alcohol consumption (≤1 drink/day or ≤12.5 g/day)[232, 233, 234] which does not significantly increase cancer risk in other organs of women[237].

- **Poor diet –** diet is considered responsible, in part, for about 30% to 40% of all cancers [8, 53, 54]. While there is no food that can prevent you from getting breast cancer, some foods can make your body healthier, improve your immune system, and help lower your risk for breast cancer.

Eating organic food that is pesticide-free may protect against unhealthy changes on a cellular level (although there are no studies showing a direct correlation between pesticide exposure and increased risk of breast cancer) [54]. Pesticides are used in many commercially grown fruit, vegetable, and grain crops. Antibiotics and other drugs are used to protect livestock from diseases and parasites. Extra hormones may be given to animals to increase their meat and milk production. While this may increase food production and reduce food loss, we need to question what these chemicals can do to our bodies.

Breast cancer is less common in countries where their diet is vegan or vegetarian and low in total fat (polyunsaturated fat and saturated fat) [53, 54]. Research on adult women in the United States hasn't found breast cancer risk to be related to dietary fat intake. More research is needed to have a better understanding of the effect of diet on breast cancer risk. It is clear, however, that calories do count, and fat is a major source of calories (twice as many calories than protein and carbohydrates).

High-fat diets can lead to obesity, which is a breast cancer risk factor [54]. Overweight women (defined as having a BMI – body mass index, over 25) are at higher risk for breast cancer because extra fat cells make estrogen, which, in turn, can cause extra breast cell growth. [53, 55]The location of the extra weight matters; extra fat around your stomach may increase risk more than the same amount of extra fat around your thighs or hips [55].

Still, the link between extra weight and breast cancer is complicated and affected by other factors. For example, the location of the extra weight matters. Extra fat around your belly may increase risk more than the same amount of extra fat around your thighs or hips.

When you cook meat at high temperatures and cook it until it is well–done, a group of chemicals known as HCAs (heterocyclic amines) form. The longer the meat cooks and the hotter the temperature that it is cooked at, the more HCAs form, especially in the blackened or charred parts of the meat. The NCI (National Cancer Institute) has identified 20 HCAs that may increase the risk of cancer [56].

Another group of chemicals – PAHs (polycyclic aromatic hydrocarbons) form in smoke produced when fat burns or drips on hot grill coals. PAHs have all been linked to breast cancer [56].

- **Low vitamin D levels –** vitamin D assists the body in the absorption of calcium. Calcium is essential for good bone health and the prevention of osteoporosis. Vitamin D also helps the immune, muscle, and nervous systems function properly. Most vitamin D is made when an inactive form of the nutrient is activated in your skin when it's exposed to sunlight. Smaller amounts of vitamin D are in fortified milk and other foods, fatty fish, and eggs.

  With all the warning about skin cancer, more and more people avoid time in direct sunlight, or they wear sunscreen when they are in the sun. As a result, vitamin D production from sun exposure is limited.

  Research has shown a connection in women with low levels of vitamin D and a higher risk of breast cancer [9]. Vitamin D may play a role in controlling normal breast cell growth and may be able to stop breast cancer cells from growing as well. People who avoid the sun, or live in areas of the country with limited sunshine, should consult their doctor about supplementing with Vitamin D.

  While sunblock can protect us from harmful ultraviolet rays, research strongly suggests that some of the chemicals in some sunscreen products may increase our risk of cancer. Many of these chemicals are considered hormone disruptors (they can affect how estrogen and other hormones act in our bodies, by blocking them or imitating them). This throws off the body's natural hormonal balance. Because estrogen can spur the growth of breast cancer in hormone-receptor-positive patients, many women choose to limit use of these types of products.
  As an alternative to the sunscreen products available at our local drug store, use a sunscreen that contains zinc or titanium. These minerals reflect the ultraviolet rays of the sun and aren't potential hormone disruptors. Try to avoid going outside during peak sun hours; usually from 10 a.m. to 4 p.m. during the summer.

  Depending on where you live and work, you're likely to be exposed to many plastic products every day. Food and beverage containers, some disposable plates, and toiletry bottles, are all plastic and all are made from chemicals. Research suggests that all plastics may leach chemicals if they're scratched or heated. Research also strongly suggests that at certain exposure levels, some of the chemicals in these products, such as bisphenol A (BPA), may cause cancer in people.

- **Exposure to chemicals in plastic –** BPA is a weak synthetic estrogen found in many rigid plastic products, food and formula can linings, dental sealants, and on the shiny side of paper cashier receipts. Its estrogen-like activity makes it a hormone disruptor, which can affect how estrogen and other hormones act in the body, by blocking them or imitating them, throwing off the body's hormonal balance. Because hormone receptor positive breast cancer can grow in the presence of estrogen, it's advisable to limit exposure to these products.

  It's almost impossible to avoid all plastic products, but try to use as little plastic as possible, and never use it around food. Use glass, porcelain, enamel-covered metal, or stainless-steel pots, pans, and containers for food and beverages whenever possible, especially if the food or drink is hot. Don't microwave food in plastic containers; the plastic residues may leach into food when heated.

- **Onset of menstrual cycle –** women who started having periods younger than age 12, have a higher risk of breast cancer later in life [3]. The same is true for women who go through menopause when they're older than 55 [3]. There has been an unexpected shift in the early onset of puberty, breast development, and menstruation over the past decade or so. Girls have been starting puberty at younger ages. This may be attributed to the hormone disruptors that are found in the chemicals and hormones in our food and environment. The earlier a girls' breasts form, the sooner they're susceptible to the hormones inside and outside of their body, thus increasing their risk of breast cancer [2].

  From the time a girl starts menstruating, to the time of her first full-term pregnancy, breast tissue tends to be especially sensitive to hormonal influences. The longer a woman menstruates, the higher her lifetime exposure to estrogen and progesterone. This is associated with a higher risk of breast cancer later in life [2].

- **Pregnancy history –** women who don't have a full-term pregnancy (or have their first child after age 30) have a higher risk of breast cancer than those women who gave birth before age 30 [2, 10]. When breast cells are made when a woman is younger, they are immature and very active until they have their first full-term pregnancy. The immature breast cells are more responsive to estrogen as well as hormone-disrupting chemicals in products. When a woman has her first full-term pregnancy, the breast cells fully mature and grow in a more regular way. Therefore, pregnancy helps protect women against breast cancer. Being pregnant also reduces the number of menstrual cycles a woman has in a lifetime; which may be another reason why getting pregnant at a younger age offers a protective effect.

  Breastfeeding can also lower your risk of breast cancer, especially if a woman breastfeeds for longer than one year [2, 11]. The benefit is not as significant for women who breastfeed for less than a year. Breastfeeding may not be possible after a breast cancer diagnosis. After a double mastectomy breastfeeding will be impossible. Following a lumpectomy and radiation, the cancerous breast usually produces little or no milk, but the other breast can make milk normally. The milk may be enough to meet the infants' needs, or it can be supplemented with formula.

PROCEDURES

Breast Conserving Surgery (BCS) – in breast-conserving surgery, only the part of the breast containing the cancer is removed. The goal is to remove the cancer as well as some surrounding normal tissue. How much of the breast is removed depends on the size and location of the tumor and other factors. If cancer cells are found near the edges of the tissue that is removed, it is said to have **positive margins**. If there are no cancer cells at the edges of the tissue, it is said to have **negative/clear** margins. The presence of positive margins means that some cancer cells may have been left behind after surgery. If there are positive margins in the tissue removed with surgery, the surgeon may need to go back and remove more tissue. This operation is called a re-excision. If the surgeon can't remove enough breast tissue to get clear surgical margins, a mastectomy may be the next step.

Women with early-stage cancers may have the option to choose between breast-conserving surgery and mastectomy. The main advantage of BCS is that a woman keeps most of her breast. The downside is that in most cases, she will also need radiation. Women who choose to undergo a mastectomy for early stage cancers are less likely to need radiation.

According to the American Cancer Society, studies following thousands of women for more than 20 years show that when BCS can be done along with radiation, having a mastectomy instead does not provide any better chance of survival [12, 57, 63].

- **Lumpectomy –** the cancerous breast tissue, with a rim of normal tissue around it, is removed. Sometimes lymph nodes in the armpit may be removed as well. Whether or not a woman can undergo a lumpectomy is determined by the size of her tumor, the size of her breast, the number of sites of cancer within the breast, and whether the patient can undergo subsequent radiation treatments, among other factors. Patients who choose lumpectomy will likely be advised to have radiation therapy to the breast area after surgery.

> Most patients will leave the hospital on the same day as the surgery. Patients should begin doing gentle range of motion and deep breathing exercises the day after surgery (with surgeon's permission). Repetitive motions with the arm on the surgical side should be aoided for two weeks after surgery. Patients should avoid strenuous activities, such as biking, jogging, weightlifting, or aerobic exercise, for 2-4 weeks or until their doctor gives them permission; this may include housework if it requires use of the arm next to the affected breast. Most people can return to their normal activities within 2 weeks. Walking is essential to a smooth recovery and should be a part of each day's activities in the recovery period. Patients usually remain fatigued for about two days after this operation and should not lift anything over five pounds for 1-2 weeks.

Potential side effects of Lumpectomy:

- Pins & needles feeling in armpit if lymph nodes were removed
- Infections
- Bleeding
- Lymphedema (radiation/lymph node removal)
- Skin tightness/adhesions
- Breast asymmetry
- Muscular weakness (primarily serratus anterior) causing muscular instability of the shoulder girdle if axillary nodes are removed

- **Total/Simple Mastectomy –** surgical removal of the entire breast and the nipple; lymph nodes are not usually removed. Sometimes lymph nodes are inadvertently removed because they are located within the breast tissue removed during surgery. A total/simple mastectomy is appropriate for women with large and/or multiple areas of ductal carcinoma in situ (DCIS) as well as for prophylactic mastectomies.

> Most patients will leave the hospital on the same day as the surgery, however some may remain hospitalized for 1-2 days. Full recovery may take up to two months. Patients should begin doing gentle range of motion and deep breathing exercises the day after surgery (with surgeon's permission). Patients should avoid strenuous activities, such as biking, jogging, weightlifting, or aerobic exercise, for 4-6 weeks or until their doctor gives them permission; this may include housework if it requires use of the arm next to the affected breast. Patients should not lift anything over two pounds for 4-6 weeks. Walking is essential to a smooth recovery and should be a part of each day's activities in the recovery period. Please see specific guidelines for breast reconstruction.

Potential side effects of Total/Simple Mastectomy:

- Depression
- Pins & needles feeling in armpit if lymph nodes were removed
- Infections
- Bleeding
- Seroma
- Hematoma
- Lymphedema (radiation/lymph node removal)
- Skin tightness/adhesions
- Breast asymmetry
- Temporary or permanent nerve damage
- Muscular weakness (primarily serratus anterior) causing muscular instability of the shoulder girdle if axillary nodes are removed

- **Skin-Sparing Mastectomy –** is a technique that preserves as much of the breast skin as possible. Skin-sparing mastectomy can be performed as a "simple" or "total" mastectomy or as a modified radical mastectomy to provide the skin needed for immediate reconstruction. Most of the breast tissue is removed, but most of the breast skin is saved to hold and shape the reconstructed breast. To perform this procedure, there can't be any evidence of cancer on or near the skin. In a skin-sparing mastectomy, the incision is made around the areola. Sometimes it is necessary to make another incision extending down or to the side to remove as much breast tissue as possible. Research shows skin-sparing mastectomies do not increase the risk for breast cancer recurrence in clients with early stage breast cancer. Many women choose this type of mastectomy in order to get the most realistic and pleasing results from immediate breast reconstruction. This procedure may not be an option for those with inflammatory breast cancer, multiple tumors, or a tumor too close to the skin.

> Most patients will remain hospitalized for 5-7 days and full recovery may take up to twelve weeks. Patients should begin doing gentle range of motion and deep breathing exercises the day after surgery (with surgeon's permission). Patients should avoid strenuous activities, such as biking, jogging, weightlifting, or aerobic exercise, for 6-8 weeks; this includes housework and activities of daily living. Patients should not lift anything over two pounds for 6-8 weeks. Walking is essential to a smooth recovery and should be a part of each day's activities in the recovery period. Please see specific guidelines for breast reconstruction.

Potential side effects of Skin-Sparing Mastectomy:

- Depression
- Pins & needles feeling in armpit if lymph nodes were removed
- Infections
- Bleeding
- Seroma
- Hematoma
- Lymphedema (radiation/lymph node removal)
- Skin tightness/adhesions
- Breast asymmetry
- Temporary or permanent nerve damage
- Implant rupture
- Capsular contracture
- Muscular weakness (primarily serratus anterior) causing muscular instability of the shoulder girdle if axillary nodes are removed

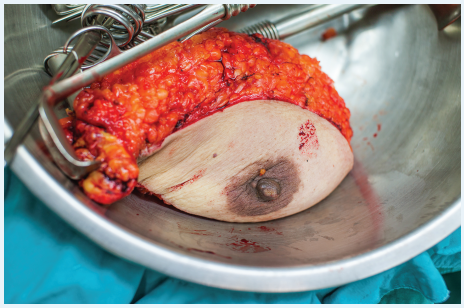
- **Nipple-Sparing Mastectomy –** in this procedure the nipple and areola are left in place while the breast tissue under them is removed. Women who have a small early stage cancer near the outer part of the breast, with no signs of cancer in the skin or near the nipple, are better candidates for nipple-sparing surgery. There are several different incisions used to do this surgery; one incision is made under the fold of the breast while other incisions begin near the areola and extend towards the outer portion of the breast. Vertical incisions from the breast fold to the nipple are also sometimes used. In all cases, all visible breast tissue is removed. Immediate reconstruction is usually done with an implant or tissue flap.

  > Since reconstruction takes place at the same time, most patients will remain hospitalized for 5-7 days depending on the reconstructive procedure that is used, and full recovery may take up to twelve weeks. Patients should begin doing gentle range of motion and deep breathing exercises the day after surgery (with surgeon's permission). Patients should avoid strenuous activities, such as biking, jogging, weightlifting, or aerobic exercise, for 6-8 weeks; this includes housework and activities of daily living. Patients should not lift anything over two pounds for 6-8 weeks. Walking is essential to a smooth recovery and should be a part of each day's activities in the recovery period. Please see specific guidelines for breast reconstruction.

Potential side effects of Nipple-Sparing Mastectomy:

- Depression
- Pins & needles feeling in armpit if lymph nodes were removed
- Infections
- Bleeding
- Seroma
- Hematoma
- Lymphedema (radiation/lymph node removal)
- Skin tightness/adhesions
- Breast asymmetry
- Temporary or permanent nerve damage
- Implant rupture
- Capsular contracture
- Muscular weakness (primarily serratus anterior) causing muscular instability of the shoulder girdle if axillary nodes are removed

- **Modified Radical Mastectomy –** is the surgical removal of the breast, the nipple, many of the axillary lymph nodes, and the lining over the chest muscle. This procedure has replaced the radical mastectomy as the most common surgery for breast cancer. The patient may opt for immediate reconstruction or put it off for a later time. The nipple and areola may be reconstructed later. The new nipple won't have any sensation, and there will most likely be significant numbness in the remaining skin of the breast.



Most patients will remain hospitalized for 1-2 days; longer if immediate reconstruction is performed. Full recovery may take up to two months. Patients should begin doing gentle range of motion and deep breathing exercises the day after surgery (with surgeon's permission). Patients should avoid strenuous activities, such as biking, jogging, weightlifting, or aerobic exercise, for 4-6 weeks; this includes housework and activities of daily living. Patients should not lift anything over two pounds for 4-6 weeks. Walking is essential to a smooth recovery and should be a part of each day's activities in the recovery period. Please see specific guidelines for breast reconstruction.

Potential side effects of Modified Radical Mastectomy:

- Depression
- Pins & needles feeling in armpit if lymph nodes were removed
- Infections
- Bleeding
- Seroma
- Hematoma
- Lymphedema (radiation/lymph node removal)
- Skin tightness/adhesions
- Breast asymmetry
- Temporary or permanent nerve damage
- Muscular weakness (primarily serratus anterior) causing muscular instability of the shoulder girdle if axillary nodes are removed

- **Radical Mastectomy -** surgical removal of the breast, the pectoralis major and minor, all the axillary lymph nodes, and some additional fat and skin. This procedure is rarely, if ever, performed today because modified radical mastectomies have proven to be equally as effective and less disfiguring. People may still have a radical mastectomy if they have large tumors that are growing into the chest wall muscles.

Potential side effects of Radical Mastectomy:

- Depression
- Deformity/large depression in the chest wall
- Inability to bring arm across the chest in a raised position (horizontal adduction)
- Possible pulmonary problems
- Frozen shoulder
- Pins & needles feeling in armpit
- Infections
- Bleeding
- Seroma
- Hematoma
- Temporary or permanent nerve damage
- Lymphedema (radiation/lymph node removal)
- Skin tightness/adhesions
- Muscular weakness (primarily serratus anterior) causing muscular instability of the shoulder girdle if axillary nodes are removed
- Reduced shoulder stabilization and ability to rotate the shoulder blade upward, limiting the ability to raise the arm out, away from the body (abduction), or in front of the body (flexion)

- **Axillary Node Dissection (ALND) –** a standard dissection consists of sampling the level I (beneath the armpit) and level II nodes (in the armpit itself). Generally, about fifteen nodes are taken through a separate incision in the fold of the armpit. The number of nodes is not set in stone. The actual number may vary from as few as four to as many as thirty. If the nodes test negative for cancer, the odds that the disease has infiltrated level III (in front of the shoulder) are less than 1%. In a complete axillary dissection, removing all three levels usually excises over two dozen nodes.

Potential side effects of Axillary Node Dissection:

- Lymphedema
- Reduced arm and shoulder function (strength and range of motion)
- Weakness in the serratus anterior
- Tightness in the skin under the arm
- Numbness
- Recurrent infections
- Frozen shoulder
- Axillary web syndrome

- **Sentinel Node Biopsy –** the sentinel node is the first node to receive the lymph that drains from the cancerous area. It will be the node most likely to contain cancerous cells if they have spread from the primary site. If this node is found to be clear, it is thought the nodes beyond it will also be clear of the disease. The procedure is performed by injecting a blue dye into the tumor site. A small incision is made under the armpit and the surgeon identifies and removes the first lymph node to turn blue – the sentinel node. If the sentinel node comes back from pathology testing positive for cancer, the surgeon will usually go on to perform a complete axillary node dissection.

Potential side effects of Sentinel Node Biopsy:

- Minimal tightness in the skin under the arm
- Lymphedema
- Axillary web syndrome

Axillary Web Syndrome (lymphatic cording) - is a painful and functionally limiting complication of breast cancer surgery, axillary lymph node dissection, or sentinel node biopsy. Patients describe cord-like structures in the axilla extending into the distal arm causing pain, limited shoulder ROM and functional compromise. Cording appears as a web of thick, ropelike structures under the skin of the inner arm and typically form in the axilla (armpit area), and sometimes extends down most of the upper arm and even into the hand; some women may also notice cords in the chest. One long cord of scar tissue may develop or several smaller cords may run down the arm. Cords tend to be painful and tight. This makes lifting the arm above the shoulder, or extending the elbow fully, very difficult.

Doctors are unsure as to the exact cause of AWS. One theory is that breast surgery may traumatize the blood vessels and connective tissue under the arm. The trauma leads to inflammation, scarring, and eventually hardening of the nearby soft tissue. Some patients may not notice the cord structures themselves but may be bothered by other symptoms including pain and tightness in the area or a reduction in the range of motion of the arm. Symptoms of cording usually appear within several days or weeks after surgery, with a few cases having been reported months after surgery.

The National Lymphedema Network (NLN) reports that AWS occurs in 6-72% of women who have undergone an axillary node dissection and 20% of women who have undergone a sentinel node dissection in addition to lumpectomy or mastectomy [13]. In most patients, cording appears to resolve within two to three months, so unlike lymphedema, it's not likely to be a problem for the rest of one's life. However, NLN notes that 15% of patients who do not seek medical attention for the problem may experience symptoms for longer than six months [13].

Cording can cause a decrease in active range of motion (AROM), passive range of motion (PROM), and normal function: pain is usually associated with this. Treatment is usually long tissue stretching and myofascial relief techniques (usually done by a Physical Therapist). It is important that these clients be on a home-based exercise program of stretching exercises during and after completion of physical therapy. With treatment, AROM and PROM will improve, pain will decrease but visible signs of cording may always be present.

SLNB = sentinel lymph node biopsy
ALND = axillary lymph node dissection
XRT = radiation therapy

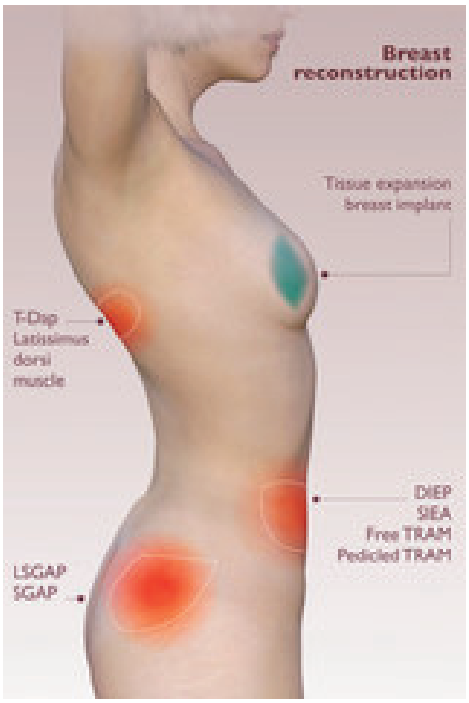
Number of lymph nodes removed correlates with the risk of developing lymphedema.
Risk is approximately ½ with SLNB

SLNB = 8%
SLNB + XRT = 17%
ALND =15%
ALND + XRT =30%

Ameer et al. Lymphology 2004

Types of treatment used:

- External beam radiation
- Brachytherapy
- Chemotherapy
- Hormonal therapy
- Hyperthermia
- Targeted therapy
- Immunotherapy
- Monoclonal antibodies
- Monoclonal antibody attached to chemotherapy



BREAST RECONSTRUCTION

Some of the factors that are considered when considering reconstruction options include:

- The overall health of the patient (including issues that might affect healing, such as smoking or certain health conditions)
- The size and location of the breast cancer
- Breast size
- The extent of breast cancer surgery
- Whether there will be adjuvant treatments other than surgery for the cancer
- The amount of tissue available (is there enough tissue and fat in the area to reconstruct the breast)
- Whether there will be reconstructive surgery on one or both breasts
- The desire to match the unaffected breast
- Insurance coverage and related costs for the unaffected breast
- Recovery time
- Willingness for multiple cosmetic surgeries
- The effects that different types of reconstructive surgery might have on other parts of your body (muscle imbalances that can affect activities of daily living)

- **Implants / tissue expanders –** implants have a silicone shell filled with either silicone gel or salt water (saline). Some newer types use thicker silicone gel, called cohesive gel. The thickest ones are sometimes called "gummy bear" implants and are made of highly cohesive silicone. They are more accurately called ***"form-stable implants,"*** meaning that they keep their shape even if the cover is cut or broken. Form-stable implants were approved in early 2013 in the United States [65].

TYPES OF IMPLANT SURGERY:

- **One-stage immediate breast reconstruction –** is also called direct-to-implant reconstruction. For this, the final implant is put in at the same time as the mastectomy is done; the implant may be placed either above or below the pectoral muscle and a graft or an absorbable mesh is used to hold the implant in place.

- **Two-stage reconstruction (delayed immediate reconstruction) –** means that a short-term tissue expander is put in after the mastectomy. The expander is a balloon-like sac that's slowly filled over and expanded to the desired size to allow the skin flaps to stretch. Two types of expanders are available:

  - In one type, the surgeon injects a salt-water solution through a tiny valve under the skin at regular intervals (every 1, 2, or 3 weeks) to fill the expander over several months.

  - In the other type, known as AeroForm®, the expander contains compressed carbon dioxide gas. The patient uses a remote control to release small amounts of the gas into the expander several times a day over 2 to 3 weeks.

  After the skin over the breast area has stretched enough, a second surgery will remove the expander and put in the permanent implant. Tissue support is sometimes needed for breast reconstruction with implants. The tissue will provide additional coverage over the implant, hold the implant in place, or position the muscle where it needs to be. There are several ways that this can be accomplished:

  - Tissue from another part of the body, such as the stomach or back, can be used to create a "pocket" to hold the implant in place or to provide added skin coverage over the implant.

  - Acellular dermal matrix (donated human skin) that has had the human cells removed, reducing any risk that the transplant carries any diseases, or that the body will reject them. They are used to extend and support the individual's natural tissues and help them grow and heal.

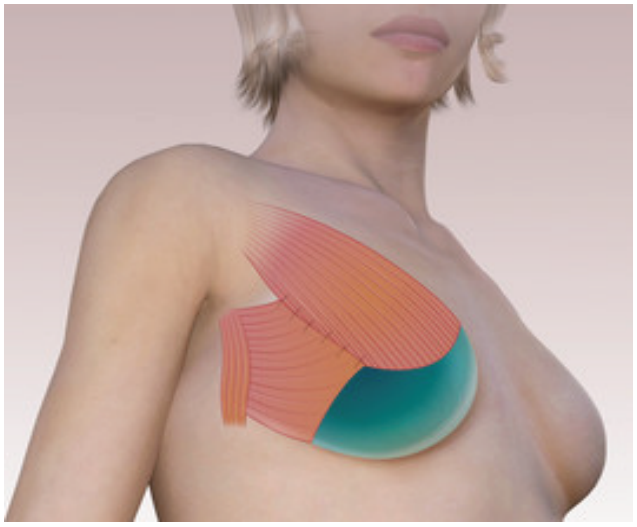
  - Animal skin (usually from a pig) with the cells removed (an acellular matrix such as Strattice™ or Permacol™), may also be used. The acellular matrix products are newer in breast reconstruction. This type of tissue is not readily available but is becoming more widely used.

Most patients will leave the hospital the same day as surgery. Full recovery may take 4-6 weeks. Patients should begin deep breathing and simple exercises such as shoulder rolls, shoulder shrugs, and arm circles (pendulum swings) 1 day after surgery (with surgeon's permission). It is important that patients are not doing anything that involves pulling or pushing (getting out of bed, opening a heavy door, taking a turkey out of the oven, etc). Patients should not perform any chest stretches or other exercises engaging the pectoral muscles while expanders are in place. Walking is essential to a smooth recovery and should be a part of each day's activities in the recovery period.

Three to four weeks after surgery patients can begin weightless shoulder ROM exercises that will assist with flexion, extension, abduction, internal and external rotation. At this time (in the absence of expanders) they may also begin gentle chest stretches and light housework. Patients should avoid strenuous activities such as biking, jogging, weightlifting, or aerobic exercise for 6-8 weeks. Patients should not lift anything over two pounds for 6-8 weeks.

Potential side effects of saline implants and tissue expanders:

- *Capsular contracture* – a condition in which scar tissue around the implant or expander hardens and then contracts. This can cause deformity, pain, and abnormal firmness of the breast
- Pectoralis major may go into painful spasms
- Rupture
- Loss or changes in nipple and breast sensation
- Asymmetry



BREAST CANCER RECOVERY WITH THE BOSU® BALANCE TRAINER ADVANCED QUALIFICATION
ANDREA LEONARD

- **Latissimus Dorsi Flap (LAT) Flap –** in this procedure, a football-shaped section of skin, fat, blood vessels, and the latissimus muscle from the back are brought to the front of the chest. This is done by creating a "tunnel" under the skin of the armpit and pulling the muscle through the tunnel and out the mastectomy scar in the front. The muscle is then used to form a breast mound, or, more commonly, is folded to create a pocket in which an implant is placed. An implant may be place either above or below the pectoral muscle. The skin taken from the back is sewn into place on the front of the chest with all the blood vessels remaining intact. The LAT Flap may be used in delayed or immediate reconstruction, in combination with tissue expanders for a staged reconstruction, with implant-based immediate reconstruction, or alone as an autogenous flap.

  Most patients will remain in the hospital for 4 days. Full recovery may take 4-8 weeks. For the first 2 weeks patients should avoid:

  - Lifting affected arm above the height of the shoulder
  - Lifting or pushing with affected arm
  - Lifting anything heavier than one pound with affected arm
  - Pushing oneself up from bed using the affected arm
  - Pushing doors open with affected arm
  - Pulling anything with affected arm

  Patients should begin deep breathing and simple exercises such as shoulder rolls, shoulder shrugs, and arm circles (pendulum swings) 1 day after surgery (with surgeon's permission). Walking is essential to a smooth recovery and should be a part of each day's activities in the recovery period.

  Three to four weeks after surgery patients can begin weightless shoulder ROM exercises that will assist with flexion, extension, abduction, internal and external rotation. At this time they may also begin gentle chest stretches and light housework. Patients should avoid strenuous activities such as biking, jogging, weightlifting, or aerobic exercise for 12 weeks. Patients should not lift anything over two pounds for 6-8 weeks.

Potential side effects of Latissimus Dorsi Flap:

- Weakness in the muscles supporting the shoulder blade
- Difficulty lifting and twisting
- Capsular contracture/rupture (with implant)
- Tissue death (necrosis)
- Blood clots
- Infection
- Prolonged healing time

- **Trans Rectus Abdominis Myocutaneous (TRAM) Flap –** in this procedure, a football-shaped section of skin, fat, blood vessels, and part, or all the rectus abdominis muscle from the abdominal area is pulled up through a "tunnel" under the skin of the upper abdomen to form a breast mound on the chest. The skin is sewn into place with all the nerves and blood vessels remaining intact. This procedure can also be done as a Free Flap (see definition on next page) for those who may not be candidates for the TRAM flap due to prior surgeries or compromised blood vessels.

  Most patients will remain in the hospital for 5-7 days. Full recovery may take up to a year. For the first 2 weeks patients should avoid:

  - Lifting affected arm above the height of the shoulder
  - Lifting or pushing with affected arm
  - Lifting anything heavier than one pound with affected arm
  - Pushing oneself up from bed using the affected arm
  - Pushing doors open with affected arm
  - Pulling anything with affected arm

  Patients should begin deep breathing and simple exercises such as shoulder rolls, shoulder shrugs, and arm circles (pendulum swings) 1 day after surgery (with surgeon's permission). Walking is essential to a smooth recovery and should be a part of each day's activities in the recovery period. It may be difficult for the first 2-3 weeks just getting in and out of a chair, using the toilet, getting in and out of bed, etc.

Three to four weeks after surgery patients can begin weightless shoulder ROM exercises that will assist with flexion, extension, abduction, internal and external rotation. At this time they may also begin gentle chest stretches and light housework. Patients should avoid strenuous activities such as biking, jogging, weightlifting, or aerobic exercise for 12 weeks. Patients should not lift anything over two pounds for 6-8 weeks.

The first few weeks, the patient may find that they have difficulty standing erect. This may be due to pain, fear, or any number of other factors. Eventually, due to the lack of rectus abdominis muscle, they will most likely take on an excessively lordotic posture due to lack of strength in the abdominal area and over-compensating lower back muscles and spinal stabilizers. If they only had a single rectus pedicle used for reconstruction, they will "technically" still be able to do crunch-type exercises. This makes no sense, however, because it will create a lateral imbalance. If both pedicles are used it will be virtually impossible to perform crunch-type exercises. Focus on core work and good posture!

Potential side effects of TRAM Flap:

- Abdominal and lower back weakness and pain
- Hernia
- Decreased trunk stability
- Difficulty standing erect
- Tissue death (necrosis)
- Blood clots
- Infection
- Prolonged healing time
- Loss or changes in nipple and breast sensation

- **Free Flap –** this procedure is like the TRAM flap in that skin, muscle (in a rectus abdominis flap), fat, and blood vessels are transferred from the abdomen, or other area of the body, to the chest to make a breast mound. The difference, however, is that instead of leaving all the tissue intact and tunneling it under the skin and up to the chest, the tissue – blood vessels and all – is cut out and then reattached to the chest. This is a much more complicated and intense surgery, as each tiny blood vessel must be reattached to ensure proper blood supply to the tissue.

Types of Free Flaps:

- **DIEP (Deep Inferior Epigastric Perforator) Flap –** this is the named vessel for which the tissue to be transferred is based. The deep inferior epigastric vessels arise from the external iliac vessels and course beneath the rectus abdominis on each side. These vessels "send-off" branches to the muscle as well as through the muscle and the overlying fat. These perforating vessels are those which are identified, preserved, and transferred with the overlying tummy fat to reconstruct the breast. You are a candidate for this procedure if the amount of fat you have on your lower abdomen is enough to reconstruct one or both breasts to the desired volume. Unlike the TRAM flap prior abdominal operations ***does not*** exclude the DIEP flap from use. A prior tummy-tuck does exclude the DIEP from being used. Most plastic surgeons don't perform perforator breast reconstruction due to its complexity. It is technically very difficult and time consuming and usually necessitates a microsurgeon. The DIEP is a "muscle preserving" procedure and doesn't sacrifice the rectus abdominis muscle.

- **SIEA (Superficial Inferior Epigastric Artery) Flap –** this procedure uses fat, blood vessels, nerves and skin from the lower abdomen to create breast tissue. It is different from the DIEP flap because it does not require blood vessels going through or around the abdominal muscles. This means the abdominal muscles are undisturbed, so there is minimal risk of abdominal wall weakness. The SIEA flap technique also takes less time than the DIEP flap. The downside is that the SIEA flap can be used in only 15 percent of patients and it is not possible to determine this prior to surgery. In the operating room the surgeon will evaluate the SIEA blood vessels to determine if this flap is feasible, in which case they will preferentially use this technique over the DIEP.

- **GAP (Gluteal Artery Perforator) Flap –** this may be described as S-GAP or IGAP. The prefixes define superior or inferior branches of the gluteal artery. As with the DIEP, the gluteal artery perforator arises from a branch of the gluteal artery, courses through the muscles, and delivers blood to the overlying buttock fat. This procedure allows for use of buttock fat to reconstruct the breast when abdominal fat is inadequate. Like the DIEP it is a "muscle preserving" procedure and doesn't sacrifice the buttock muscle.

- **TDAP (Thoracodorsal Artery Perforator) Flap –** this procedure harvests upper back skin and fat to create the reconstructed breast. This is not one of the more commonly used procedures for reconstruction and is typically used for augmenting the volume or perfecting the contour of an already-reconstructed breast. It provides a long, thin, and pliable skin flap with a good cosmetic result. The TDAP flap is a "perforator" flap, thereby leaves the latissimus dorsi muscle (LAT Flap) intact. Preserving the muscle reduces shoulder instability as well as muscle imbalances that typically arise following a LAT Flap procedure. The TDAP Flap is usually combined with a breast implant because there is typically not enough tissue to provide adequate volume for the newly constructed breast. It is an ideal flap when there is radiation damage to the breast, or if small volumes of tissue are required to shape the new breast.

- **TUG (Transverse Upper Gracilis) Flap –** also known as the inner thigh flap – Is a newer option for breast reconstruction. The TUG flap utilizes fatty tissue of the inner thigh to reconstruct the breast. The gracilis muscle and its blood vessels carry the blood supply and allow the free transfer to the chest. The skin and fat of the inner thigh flap can be a transversely oriented ellipse just below the groin and buttock crease, which allows the donor site to be closed like a thigh lift, resulting in a well-hidden scar. Alternatively, the incision can be extended vertically along the inner thigh to capture more tissue volume. This allows larger breasts to be reconstructed with the inner thigh flap. Your client will be provided with a compression garment for the thighs after the procedure. Sitting in a chair for any extended time should be avoided during the first two weeks after surgery, lying in bed, sitting in a reclining chair, and walking will not interfere with the wound healing and is encouraged. Advantages to TUG flap reconstruction include the softness and pliability of the tissue from the inner thigh which provides for excellent shaping of a natural looking breast with excellent projection. The scar on the thigh is well hidden and the cosmetic result on the thigh is comparable to a thigh lift procedure. Compared to the GAP flap procedure, the operative set up is more efficient, allowing for a much easier flap elevation. Following the transfer of the gracilis muscle, the other adductor muscles will compensate for its function.

There may be some internal rotation on the affected hip from the scar tissue and possible adhesions. It will be important to recognize any imbalances and correct them with leg stretches and targeted strength training. Exercises that focus on abduction of the thighs will be quite beneficial for this situation. As with most breast surgeries, there will be tightness in the chest wall from surgery, radiation to the area, breast reconstruction, and general poor posture; you will typically present with round shoulder syndrome and forward head. The focus will be to stretch the chest and strengthen the back.

NIPPLE/AREOLA RECONSTRUCTION

TYPES OF NIPPLE/AREOLAR RECONSTRUCTION

- **Skin grafts –** a 2-dimensional structure, the areola usually does not pose the same degree of difficulty in reconstruction as the nipple. Time-honored methods of reconstruction included skin grafts obtained from the contralateral nipple-areola complex or the medial thigh-vulva area. These grafts were intended to provide pigmented tissue that closely resembled the native areola. Currently, with great improvements in tattoo technique and seemingly endless variety of pigments available, it seems unjustifiable to expose a patient to the risks of possible donor site complications to obtain the same or less satisfactory result than one obtainable with tattoo.

- **Tattoo –** tattooing of the reconstructed breast in the area of the expected nipple areola complex is simple, easy to perform, readily correctable, and requires no significant patient participation or convalescence. Reconstruction of the areola by tattooing can be staged and often requires some touch-up, but it allows a great degree of control over size, definition of the contour, and color match with the contralateral side; however, results are usually less than satisfactory when used in the absence of nipple reconstruction. Tattooing is strictly an optical effect, with no structural support and no way to reproduce the projection and texture typical of the natural nipple-areola complex. Thus, tattooing is best employed as a stage of the combined approach toward nipple reconstruction, whether performed prior to or after elevation of the nipple structure.

Many tattoo pigments are available, allowing precise color matching with the contralateral areola. Choose a shade just darker than the desired color to allow for some fading, which necessarily occurs in the weeks post injection. One or more applications may be necessary to obtain the desired result. Commercial surgical tattoo equipment usually is adequate to treat thick skin, such as the lower abdominal and back skin transferred with myocutaneous reconstruction flaps, and the injection technique is acquired easily with minimal practice. In some cases, it may be advisable to tattoo the skin prior to elevation of the nipple structure, to facilitate later touch-up and obtain a more natural color distribution.

- **Nipple reconstruction –** the most challenging aspect of nipple reconstruction is the creation of a 3-dimensional projecting structure with texture, dimensions, and contour like the contralateral nipple. Moreover, the reconstruction must last. Nipple reconstruction enhances the realism of breast reconstruction, and the more projecting and 3-dimensional the structure, the more lifelike the reconstruction. Various options have included banking, nipple sharing, grafting, and local flaps. Nipple reconstruction with local flaps is achieved with various techniques, each with its own proponents and benefits. These include the skate flap, bell flap, double opposing tab flap, star flap, top-hat flap, twin flap, propeller flap, S flap, rolled dermal-fat flap, and autologous cartilage.

CHAPTER THREE
CANCER TREATMENT

Objective: to add to your exercise "equation" (ROM + Muscle Imbalances + Cancer Treatment + Cancer Surgeries = Individual Protocol) to determine programming.

- Compliance
- Minimize & prevent pain
- Activities of Daily Living (ADL's)
- Immunocompromization precautions
- Short-term vs. long-term side-effects
- Chemo-brain
- Peripheral neuropathy modifications
- Strengthen heart & lungs

Goal: to create a program that will be safe & effective and to know how and when to progress/regress on a daily, weekly, or monthly basis. Getting the client moving, if only for ten minutes per day, should be seen as a success.

CHEMOTHERAPY

Chemotherapy – is the administration of anti-tumor drugs that destroy cancerous tumor cells. It can be given as the primary therapy for advanced cancers, or, as an adjuvant therapy with other localized treatments such as radiation. As with radiation, the goal is to destroy the cancerous cells and minimize the damage and limit the disruption of the normal cells. However, due to the similarity between normal and cancerous cells, it becomes very difficult to destroy the cancerous cells without affecting normal cells. Chemotherapy attempts to target rapidly dividing cells. Because cancerous cells are dividing more rapidly than normal cells, chemotherapy destroys a higher percentage of cancerous cells than normal cells.

The length of chemotherapy treatment is determined by a variety of factors; the type of cancer, the extent of cancer, the types of drugs that are given, as well as the expected toxicities of the drugs and the amount of time necessary to recover from these toxicities [67, 68]. Many chemotherapy treatments have been determined through clinical trials that compared them and determined which had the most benefit and was most well tolerated.

In general, chemotherapy treatment is given in cycles. This allows the cancer cells to be attacked at their most vulnerable times and allows the body's normal cells time to recover from the damage. There are three considerations regarding the cycle time:

- **Duration of the cycle -** drugs may all be given on a single day, several consecutive days, or continuously as an outpatient or as an inpatient. Treatment could last minutes, hours, or days, depending on the specific protocol.

- **Frequency of the cycle -** may repeat weekly, bi-weekly, or monthly. Usually, a cycle is defined in monthly intervals. For example, two bi-weekly chemotherapy sessions may be classified as one cycle.

- **Number of cycles -** in most cases, the number of cycles - or the length of chemotherapy from start to finish - has been determined by research and clinical trials.

    - When cure is the treatment goal, adjuvant therapy may last 4-6 months. Adjuvant chemotherapy is common in cancers of the breast and colon. In cancers of the testis, Hodgkin and non-Hodgkin lymphoma, and leukemias, length of chemotherapy treatment may be up to a year.

    - When there is visible disease, the length of chemotherapy treatment will depend upon the response of the disease to therapy. If the disease disappears completely, chemotherapy may continue for 1-2 cycles beyond this observation to maximize the chance of having attacked all microscopic disease.

    - If the disease shrinks but does not disappear chemotherapy will continue if it is tolerated, and the disease does not grow.

    - If the disease grows, the chemotherapy will be stopped. Depending on the health and wishes of the patient, either different drugs will be given to try to kill the cancer, or chemotherapy will be stopped, and the goal will become palliative rather than curative.

THERE ARE SEVERAL CATEGORIES OF CHEMOTHERAPY DRUGS:

- **Alkylating agents -** are most active in the resting phase of the cell. These types of drugs are cell-cycle non-specific. There are several types of alkylating agents used in chemotherapy treatments:
  - Ethylenimines - Thiotepa and Hexamethylmelamine
  - Alkylsulfonates - Busulfan
  - Metal salts - Carboplatin, Cisplatin, and Oxaliplatin
  - Hydrazines and Triazines - Altretamine, Procarbazine, Dacarbazine and Temozolomide
  - Mustard gas derivatives - Mechlorethamine, Cyclophosphamide, Chlorambucil, Melphalan, and Ifosfamide
  - Nitrosureas: Carmustine, Lomustine and Streptozocin. Nitrosureas are unique because, unlike most types of chemo treatments, they can cross the blood-brain barrier. They can be useful in treating brain tumors.
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  - Vinca alkaloids - Vincristine, Vinblastine and Vinorelbine
  - Taxanes - Paclitaxel and Docetaxel
  - Podophyllotoxins - Etoposide and Tenisopide
  - Camptothecan analogs - Irinotecan and Topotecan
- **Antitumor antibiotics -** are chemotherapy treatments made from natural products produced by species of the soil fungus Streptomyces. These drugs act during multiple phases of the cell cycle and are considered cell-cycle specific. There are several types of antitumor antibiotics:
  - Anthracyclines - Doxorubicin, Daunorubicin, Epirubicin, Mitoxantrone, and Idarubicin
  - Chromomycins - Dactinomycin and Plicamycin
  - Miscellaneous - Mitomycin and Bleomycin
- **Antimetabolites -** are types of chemotherapy treatments that are very similar to normal substances within the cell. When the cells incorporate these substances into the cellular metabolism, they are unable to divide. Antimetabolites are cell-cycle specific. They attack cells at very specific phases in the cycle. Antimetabolites are classified according to the substances with which they interfere.
  - Folic acid antagonist - Methotrexate
  - Pyrimidine antagonist - 5-Fluorouracil, Foxuridine, Cytarabine, Capecitabine, and Gemcitabine
  - Purine antagonist - 6-Mercaptopurine and 6-Thioguanine
  - Adenosine deaminase inhibitor - Cladribine, Fludarabine, Nelarabine and Pentostatin
- **Toposiomerase inhibitors -** are types of chemotherapy drugs that interfere with the action of topoisomerase enzymes (topoisomerase I and II). During the process of chemo treatments, topoisomerase enzymes control the manipulation of the structure of DNA necessary for replication.
  - Topoisomerase I inhibitors - Ironotecan, topotecan
  - Topoisomerase II inhibitors - Amsacrine, etoposide, etoposide phosphate, teniposide
- **Several useful types of chemotherapy drugs are unique:**
  - Ribonucleotide reductase inhibitor - Hydroxyurea
  - Adrenocortical steroid inhibitor - Mitotane
  - Enzymes - Asparaginase and Pegaspargase
  - Antimicrotubule agent - Estramustine
  - Retinoids - Bexarotene, Isotretinoin, Tretinoin (ATRA)

ADMINISTRATION:

- **Oral chemotherapy medications -** those that can be swallowed and are absorbed by the stomach or under the tongue.
  - ***Oral chemo medications that are swallowed*** are encased in a protective coating that is broken down by the digestive juices in the stomach, allowing them to be absorbed through the lining of the stomach
  - Some therapy medications are extended release, allowing longer periods of time between doses
  - ***Sub-lingual chemo medications*** are adsorbed under the tongue where they dissolve and quickly absorb into the circulation of the body. Anti-nausea medications are particularly effective when given in this manner, as they will not be lost if the patient vomits.
  - Some medications cannot be given orally because the stomach acids destroy them.
    Other medications cannot be absorbed into the patient's body through the lining of the stomach or intestines. If the drug cannot be absorbed it is passed through the stool or urine and is ineffective. Other medications may be too harsh and could cause damage to the stomach lining.
  - Some chemotherapy can be given by multiple methods such as oral or intravenous depending on the strength, convenience, and regimen that has been prescribed.
- **Subcutaneous injections (sub-q) -** involve the use of a short needle such as those used by diabetics for the injection of insulin
  - With subcutaneous injection of chemo treatment, the needle goes into the space between the skin and muscle but does not enter as far the muscle layer
  - Subcutaneous chemo injections are commonly used for some types of biologic response modifiers and chemotherapy support drugs
  - If a patient's platelet count is low subcutaneous injections are less likely to cause bleeding than intra-muscular injections
- **Intra-muscular injections -** are given through the skin into the muscle layer. This involves the use of a larger needle with deeper penetration than the subcutaneous injection.
  - Absorption of the medication is more rapid then the oral form but slower then sub lingual, subcutaneous injection, and intravenous administration
  - Intra-muscular injection is a popular method for anti-nausea medications because it bypasses an already irritated stomach
  - Most chemotherapy ***cannot*** be given intra-muscularly because of the harshness of the chemical
  - Intra-muscular injection is avoided when possible in patients with low platelets, as bleeding within the muscle can be a complication
- **Intravenous administration of therapy medication -** allows for rapid entry into the body's circulation, where it is carried throughout the body in the blood stream. This is the most common method of chemotherapy administration, since most chemo drugs are easily absorbed through the blood stream. Doses can be given as an IV bolus lasting from a few minutes to a few hours. Continuous infusions can be given over a few days or for weeks at a time. Portable pumps allow medication to be given at a slow continuous rate allowing for on-going IV absorption of the medication. Intravenous medications are given directly into the blood stream through a variety of methods:
  - **An angiocatheter** may be placed in a vein in the arm or hand and then removed after the chemo medication is given. This is a temporary venous-access device inserted by a nurse prior to treatment then removed after treatment has been completed. The in-use time of angiocatheters generally ranges from a few minutes to a few days.
  - **PICC line** is still considered temporary but can be inserted and used for six weeks to a few months before it is discontinued. PICC line insertion involves the placement of a long plastic catheter into one of the larger veins of the arm. This procedure is a non-surgical outpatient procedure. A special x-ray, called fluoroscopy will confirm that the PICC line catheter is in the right place. This option is ideal for multiple short infusions or continuous infusions given in a hospital or at home with a portable pump.

- **Non-tunneled catheters** are inserted directly through the skin into the jugular or subclavian vein and travel through the vessel to the superior vena cava vessel at entrance of the right atrium of the heart. These can be inserted at the bedside, in a non-surgical setting. A special x-ray, called fluoroscopy, must be done to be sure the catheter is in the right place. These are used most commonly short term or in emergency situations since long-term use is associated with the potential for infection along the catheter. Most refer to these catheters as "jugular" or "subclavian" for the vein in which it is inserted. These catheters require dressing changes and careful maintenance.

- **Tunneled Catheters** are placed through the skin in the middle of the chest. They are tunneled through the subcutaneous tissue and inserted into the superior vena cava vessel at entrance of the right atrium of the heart. There is a dacron cuff about two inches from the part of the catheter that exits the skin in the chest. Scar tissue forms around the cuff to hold the catheter in place. These catheters are inserted in an outpatient surgical procedure and a fluoroscopy must be done to be sure the catheter is in the right place. These catheters can be left in place for months or years with low incidence of infection. Dressing changes and maintenance is required. These catheters can have multiple lumens (entrances) for medications to be infused or for blood to be drawn. A single lumen has one entrance for medications, a double lumen has two entrances and a triple lumen (the most available) has three entrances. These catheters are most often used for extensive chemotherapy regimens such as bone marrow transplant procedures. Tunneled catheters are usually called by their brand names: Broviac, Groshong, and Hickman. The Hickman catheter, like the Broviac cathether, has an open-ended line inside the vein. In contrast, the Groshong catheter has small, valve-like openings in the line's tip.

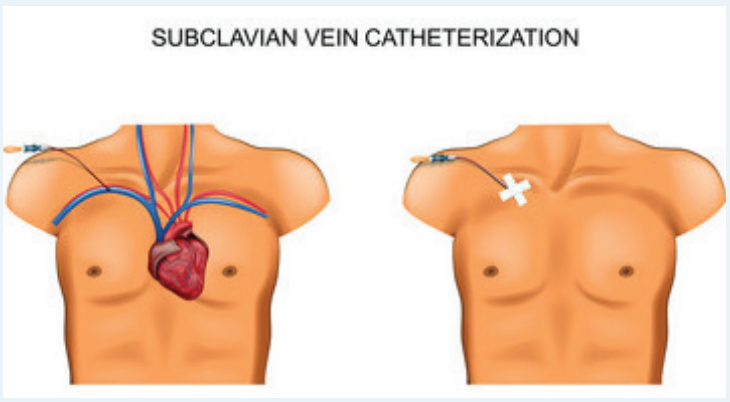
  - **Port-a-cath** is placed under the skin on the chest. The catheter is then inserted into the superior vena cava vessel at entrance of the right atrium of the heart. This catheter can be placed in radiology by an interventional radiologist or by a surgeon in the operating room. It is approximately a one-hour procedure. The useful lifetime of a port-a-cath can be as long as three to five years. The port-a-cath can be felt under the skin and the nurse can find the entrance by locating the edges of the port-a-cath and inserting a special needle into the soft middle section. Medications can be given through the port-a-cath and blood can be drawn from it eliminating the need for a blood draw from the arm. The use of a portable pump and port-a-cath allows the medication to be given over several days in the home setting rather than as a patient in the hospital. There are no dressing changes required but there is some maintenance involved.

- **Intraventricular or intrathecal chemotherapy -** is used when drugs need to reach the cerebrospinal fluid (CSF). The body's blood-brain barrier does not allow many chemotherapy drugs given systemically to get to the CSF. There are two ways chemotherapy can be given to the CSF:

  - **Lumbar puncture (Intrathecal) -** a small amount of chemotherapy is injected during the lumbar puncture, directly into the CSF. Once the drug is administered the catheter is removed.

  - **Ommaya reservoir (Intraventricular) -** is a small dome-shaped device with an attached catheter. It is placed into the subcutaneous on the scalp. The catheter is threaded into the lateral ventricle of the brain. The nurse or doctor will insert a small needle through the skin on the scalp into the ommaya reservoir to inject the chemotherapy.

  - This procedure is used most commonly in acute leukemias but can be used in other situations as well



- **Intraperitoneal chemotherapy** - can be given directly into the abdominal cavity. A catheter is placed through the abdominal wall with the catheter draining into the abdominal cavity. It drains into the cavity that surrounds the organs, not into the stomach or any of the other organs. Chemotherapy is then infused directly into this cavity. The patent is encouraged to change positions from side to side and lying on the back to facilitate the movement of the medication. In some cases, the medication is drained out after a few hours. In other instances, it is left inside where it is gradually absorbed. This method allows the organs to be bathed in the medication, which is then slowly absorbed into the tumor site. The rationale for this type of chemotherapy is that the tumor will be exposed to higher concentrations of medications without exposing the rest of the body to the toxicity. This type of treatment is somewhat controversial because even though the tumor concentrations of the medication are higher, the decrease in cancer has not been demonstrated. There are three ways to deliver intraperitoneal chemotherapy:

  - **Temporary single-use catheters** are inserted through the abdominal wall and removed after the chemotherapy treatment

  - **Tenckhoff catheters** are soft, flexible, silicone tubes with one or two dacron cuffs. This catheter is placed in a surgical procedure with the tip of the catheter placed near the tumor, the dacron cuffs tunneled and placed into subcutaneous tissue. Then the end of the catheter is brought out of the abdomen through a puncture. The Tenckhoff catheter may be selected for cyclic chemotherapy. There are some complications associated with the Tenckhoff catheters, namely microbial peritonitis (infection in the peritoneum) and occlusion of the catheter so that chemotherapy cannot be infused.

  - **Port-a-cath** - is placed under the skin on the abdominal wall. The catheter with multiple holes at the inserted end is then tunneled through the subcutaneous into the peritoneum. This catheter can be placed in radiology by an interventional radiologist or by a surgeon in the operating room. It is approximately a one-hour procedure. The useful lifetime of a port-a-cath can be as long as three to five years. The port-a-cath can be felt under the skin and the nurse can find the entrance by locating the edges of the port-o-cath and inserting a special needle into the soft middle section. Medications can be given through the port-a-cath and, although it can be difficult, peritoneal fluid samples and drainage can be accomplished through a port-o-cath.

- **Intra-arterial drugs -** are given into the artery that is supplying the blood to the tumor. Angiography is used to locate the arteries that supply blood to the tumor. There are two ways of giving medications intra-arterially:

  - **Temporary external catheter** can be inserted into the artery. The catheter is removed once the medication is given. The insertion site must be monitored carefully for bleeding.

  - **Implanted pump** can be surgically placed into the subcutaneous tissue with the catheter threaded into the artery. The pump can be removed once therapy is complete.

    - This type of therapy has been used most commonly for colon cancer that has spread to the liver. However, it has also been used in cancers of the head and neck, limb sarcoma, limb melanoma, gastric cancer, pancreatic cancer, and others.

    - The rationale for this type of treatment is that the tumor will have high exposure to the drug without the associated toxicity of these doses given systemically. Although the local tumor responses have been better with this therapy, there has been no survival benefit to date.

- **Intravesicular medications -** are given with the use of a urinary catheter directly into the bladder. A urinary catheter is placed, and the medication is injected into the catheter which is then clamped. Clamping the catheter allows the medication to remain in the bladder. The patient is encouraged to roll form side to side and to lie on their backs to help the medication reaching all areas of the bladder. After a predetermined time, the catheter is unclamped, and the fluid is drained. The catheter is then removed. This method is used frequently for people with superficially invasive bladder cancer.

- **Intrapleural chemotherapy -** can be given into the pleural. Intrapleural chemotherapy is used to control malignant pleural effusions. A malignant pleural effusion is an accumulation of cancerous fluid in the pleural space. The fluid may cause the lung to collapse, making breathing more difficult. Draining the fluid will help, but the fluid will usually come back unless intrapleural chemotherapy is given. This procedure is also known as sclerosis or pleurodesis.

  - A chest tube is inserted into the pleural space. Any fluid is drained (this may take several days). The chemotherapy is inserted into the chest tube.

  - The chemotherapy causes the lung to stick to the pleural lining, allowing the lung to re-expand and stay expanded.

  - Intrapleural chemotherapy is used primarily for palliative reasons

- **Implantable chemotherapy -** Gliadel® wafer is a form of the chemotherapy medication carmustine that can be placed and left in the cavity after surgical removal of a brain tumor, specifically glioblastoma multiforme. This formulation of the carmustine wafer allows the drug to be delivered directly to the site of the brain tumor. After a surgeon operates to remove the cancerous tissue in the brain, he or she implants up to eight dime-sized wafers in the space where the tumor once was. Over the following 2 to 3 weeks, the wafers slowly dissolve, bathing the surrounding cells with the chemo medication. The goal of this method of treatment is to kill tumor cells left behind after surgery while minimizing damage to the surrounding brain tissue.

- **Topical chemotherapy -** creams that are applied directly to the skin in certain cases of skin cancer. The cream is then absorbed through the skin directly into the cancerous lesion. The use of topical preparations is very limited in cancer treatments.

Potential side effects of Chemotherapy:

- Nausea
- Vomiting
- Constipation
- Diarrhea
- Hair loss
- Fatigue
- Anemia
- Pain
- Immunocompromization
- Infections
- Bleed and bruise easily
- Mouth sores
- Taste and smell changes
- Appetite changes
- Skin and nail changes
- Fluid retention
- Changes in the smell and color of urine
- Frequent need to urinate
- Instant menopause
- “Chemo-brain”
- Diabetes
- Osteoporosis
- Damage to the heart, kidneys, and lungs
- Shingles (herpes zoster)
- Peripheral neuropathy of the feet and hands
- Infertility

The following may signal low blood cell counts and should be reported immediately to the doctor:

- Unexpected bruising
- Small red spots under the skin
- Pink or reddish urine
- Black or bloody bowel movements
- Bleeding from gums or nose

The following may be signs of an infection and should be reported immediately to the doctor:

- Fever
- Chills, cough, sore throat
- Sweating
- Loose bowels or burning feeling with urination
- Unusual vaginal discharge or itching
- Redness or swelling

HORMONAL THERAPY

Hormonal therapy slows or stops the growth of hormone-sensitive tumors by blocking the body's ability to produce hormones or by interfering with effects of hormones on breast cancer cells. Tumors that are hormone insensitive do not have hormone receptors and do not respond to hormone therapy. To determine whether breast cancer cells contain hormone receptors, samples of tumor tissue that have been removed by surgery are tested. If the tumor cells contain estrogen receptors, the cancer is called estrogen receptor positive (ER positive), estrogen sensitive, or estrogen responsive. Similarly, if the tumor cells contain progesterone receptors, the cancer is called progesterone receptor positive (PR or PgR positive). Approximately 80% of breast cancers are ER positive [35]. Most ER-positive breast cancers are also PR positive. Breast tumors that contain estrogen and/or progesterone receptors are sometimes called hormone receptor positive (HR positive). Breast cancers that lack estrogen receptors are called estrogen receptor negative (ER negative). These tumors are estrogen insensitive, meaning that they do not use estrogen to grow. Breast tumors that lack progesterone receptors are called progesterone receptor negative (PR or PgR negative). Breast tumors that lack both estrogen and progesterone receptors are sometimes called hormone receptor negative (HR negative).

Hormonal therapy for breast cancer is not the same as menopausal hormone therapy (MHT) that is used to relieve menopausal symptoms. These two types of therapy produce opposite effects: hormone therapy for breast cancer blocks the growth of HR-positive breast cancer, whereas MHT can stimulate the growth of HR-positive breast cancer. For this reason, when a woman taking MHT is diagnosed with HR-positive breast cancer she is usually asked to stop that therapy.

While hormonal therapy is not a cure it can minimize the cancer's spread, often for a period of years. It may also be used palliatively to shrink a tumor that is causing pain. Bilateral prophylactic salpingo-oophorectomy has been shown to reduce the risk of ovarian cancer by approximately 90 percent and the risk of breast cancer by approximately 50 percent in women at very high risk of developing these diseases [34-36].

Several strategies are used to treat hormone-sensitive breast cancer:

- **Blocking ovarian function (ovarian ablation)**
  - The ovaries can be surgically (bi-lateral salpingo-oophorectomy) - permanent.
  - Low-dose radiation therapy can be used to completely shut down the ovaries' production of estrogen - permanent.
  - Hormonal therapy with drugs like goserelin (Zoladex®) and leuprolide (Lupron®) – temporary.
- **Blocking estrogen production** - aromatase inhibitors are used to block the activity of an enzyme called aromatase, which the body uses to make estrogen in the ovaries and in other tissues. Aromatase inhibitors are used primarily in postmenopausal women because the ovaries in premenopausal women produce too much aromatase for the inhibitors to block effectively. However, these drugs can be used in premenopausal women if they are given together with a drug that suppresses ovarian function. Examples of aromatase inhibitors approved by the FDA are anastrozole (Arimidex®) and letrozole (Femara®), both of which temporarily inactivate aromatase, and exemestane (Aromasin®), which permanently inactivates aromatase. Anastrozole and letrozole are approved to be given to postmenopausal women as initial therapy for metastatic or locally advanced hormone-sensitive breast cancer. Exemestane, is approved for adjuvant treatment of early-stage breast cancer in postmenopausal women who have received tamoxifen previously.

  Until recently, most women who received adjuvant hormone therapy to reduce the chance of a breast cancer recurrence took tamoxifen every day for 5 years. Some women may take an aromatase inhibitor every day for 5 years, instead of tamoxifen. Other women may receive additional treatment with an aromatase inhibitor after 5 years of tamoxifen. Finally, some women may switch to an aromatase inhibitor after 2 or 3 years of tamoxifen, for a total of 5 or more years of hormone therapy. Research has shown that for postmenopausal women who have been treated for early-stage breast cancer, adjuvant therapy with an aromatase inhibitor reduces the risk of recurrence and improves overall survival, compared with adjuvant tamoxifen.

- **Blocking estrogen's effects –** several types of drugs interfere with estrogen's ability to stimulate the growth of breast cancer cells:

  - **SERMs (selective estrogen receptor modulators) –** block the actions of estrogen in breast tissues and certain other tissues by "occupying" the estrogen receptors on cells. The SERM fits in the estrogen receptor, but it does NOT send messages to the cell nucleus to grow and divide. SERMs do send estrogen – like signals when they land in receptors' bone cells, liver cells, and elsewhere in the body. This means that SERMs seem to help prevent or slow osteoporosis in post-menopausal women and may help lower cholesterol. This dual effect, blocking estrogen in some places and imitating estrogen in other place, allows SERMs to have multiple beneficial effects in many women with breast cancer.

    - **Tamoxifen (Nolvadex®) –** is used to treat hormone-receptor positive early and metastatic breast cancers and to reduce breast cancer risk in undiagnosed women at higher-than-average risk of developing breast cancer.

      Certain drugs, including several commonly prescribed antidepressants (those in the category called selective serotonin reuptake inhibitors, or SSRIs), inhibit an enzyme called CYP2D6. This enzyme plays a critical role in the use of tamoxifen by the body because it metabolizes, or breaks down, tamoxifen into molecules, or metabolites, that are much more active than tamoxifen itself. The possibility that SSRIs might, by inhibiting CYP2D6, slow the metabolism of tamoxifen and reduce its effectiveness is a concern given that as many as one-fourth of breast cancer patients experience clinical depression and may be treated with SSRIs. In addition, SSRIs are sometimes used to treat hot flashes caused by hormone therapy.

    - **Toremifene (Fareston®) –** is used in postmenopausal women to treat metastatic breast cancer.

    - **Raloxifene (Evista®) –** is used in the prevention and treatment of osteoporosis in postmenopausal women and to reduce the risk of breast cancer in postmenopausal women with osteoporosis or at high risk for breast cancer.

  - **ERD's (estrogen receptor downregulators) –** work by attaching to the hormone receptors on breast cancer cells, blocking them, and causing them to break down and stop working. In addition to binding to and blocking estrogen receptors, ERDs also stop or slow down the growth of breast cancer cells by breaking down the receptors. With fewer hormone receptors available, fewer cells receive the signal telling them to grow, and the overgrowth of cancer cells can be slowed or stopped.

    - **Fulvestrant (Faslodex®) –** is approved for treating hormone-receptor-positive metastatic breast cancer in postmenopausal women with cancer that is no longer responding to hormonal therapy such as tamoxifen. Like SERMs, fulvestrant binds to the estrogen receptor and functions as an estrogen antagonist. Unlike SERMs, fulvestrant has no estrogen agonist effects; it is a pure antiestrogen. Because fulvestrant is administered intramuscularly, it should not be used in clients with certain blood disorders or in clients receiving anticoagulants (blood thinners).

  - **Combination hormonal therapy and targeted therapy**

    - **Lapatinib (Tykerb®) –** is approved to be used in combination with letrozole to treat hormone receptor–positive, HER2-positive metastatic breast cancer in postmenopausal women for whom hormone therapy is indicated.

    - **Palbociclib (Ibrance®) –** is used in combination with letrozole as initial therapy for the treatment of hormone receptor–positive, HER2-negative advanced breast cancer in postmenopausal women. Palbociclib inhibits two cyclin-dependent kinases (CDK4 and CDK6) that appear to promote the growth of hormone receptor–positive breast cancer cells. Palbociclib is also approved to be used in combination with fulvestrant for the treatment of women with hormone receptor–positive, HER2-negative advanced or metastatic breast cancer whose cancer has gotten worse after treatment with another hormone therapy.

Hormonal therapy may be used in several ways to treat breast cancer, including:

- **Adjuvant therapy for women with early-stage breast cancer –** research has shown that women who receive at least 5 years of adjuvant therapy with tamoxifen after having surgery for early-stage ER-positive breast cancer have reduced risks of breast cancer recurrence, including a new breast cancer in the other breast, and death at 15 years. A common switching strategy used for adjuvant therapy, in which patients take tamoxifen for 2 or 3 years, followed by an aromatase inhibitor for 2 or 3 years, may yield the best balance of benefits and harms of these two types of hormone therapy.

- **Treatment of advanced or metastatic breast cancer –** several types of hormone therapy are approved to treat metastatic or recurrent hormone-sensitive breast cancer. Hormone therapy is also a treatment option for ER-positive breast cancer that has come back in the breast, chest wall, or nearby lymph nodes after treatment (also called a locoregional recurrence).

- **Neoadjuvant treatment of breast cancer –** the use of hormone therapy to treat breast cancer before surgery (neoadjuvant therapy) has been studied in clinical trials. The goal of neoadjuvant therapy is to reduce the size of a breast tumor to allow breast-conserving surgery. Data from randomized controlled trials have shown that neoadjuvant hormone therapy (particularly with aromatase inhibitors) can be effective in reducing the size of breast tumors in postmenopausal women. The results in premenopausal women are less clear because only a few small trials involving relatively few premenopausal women have been conducted thus far.

- **Prevention of breast cancer in women who are at increased risk of developing the disease –** a large NCI-sponsored randomized clinical trial called the Breast Cancer Prevention Trial found that tamoxifen, taken for 5 years, reduced the risk of developing invasive breast cancer by about 50% in postmenopausal women who were at increased risk [34-36]. Long-term follow-up of another randomized trial, the International Breast Cancer Intervention Study I, found that 5 years of tamoxifen treatment reduces the incidence of breast cancer for at least 20 years [69]. A subsequent large randomized trial, the Study of Tamoxifen and Raloxifene, which was also sponsored by NCI, found that 5 years of raloxifene (a SERM) reduces breast cancer risk in such women by about 38% [69].

	ARIMIDEX	AROMASIN	FEMARA	TAMOXIF-EN	EVISTA	FARESTON	FASLODEX
Bone/joint pain	✓	✓	✓		✓	✓	✓
Osteoporosis	✓	✓	✓				
Bone- thinning	✓	✓	✓				
Nausea	✓		✓	✓	✓	✓	✓
Vomiting	✓		✓			✓	✓
Hot flashes	✓	✓	✓	✓	✓	✓	✓
Weakness	✓	✓	✓		✓		
Fatigue	✓	✓	✓	✓			✓
Headache	✓	✓	✓	✓			✓
Insomnia		✓	✓		✓		✓
Increased sweating					✓	✓	✓

	ARIMIDEX	AROMASIN	FEMARA	TAMOXIF-EN	EVISTA	FARESTON	FASLODEX
Dizziness			✓			✓	✓
Cough/hoarseness		✓					✓
Drowsiness			✓				
Higher Cholesterol			✓				
Increased blood pressure	✓						
Weight gain			✓				✓
Rapid weight gain				✓			✓
Weight loss	✓		✓				✓
Increased appetite	✓						
Loss of appetite	✓		✓		✓		✓
Stroke				✓	✓		
Endometrial cancer				✓		✓	
Blood clots				✓	✓		
General pain	✓	✓		✓		✓	✓
Mood swings	✓			✓		✓	
Anxiety		✓					
Depression		✓		✓			✓
Hair thinning	✓			✓			
Dry skin				✓	✓	✓	
Flushing/redness of skin	✓					✓	
Constipation	✓	✓	✓	✓			✓
Loss of libido				✓			
Leg cramps					✓		
Swelling	✓	✓	✓		✓	✓	✓
Flu-like symptoms	✓	✓	✓		✓		✓
Hypercalcemia						✓	
Rash			✓		✓	✓	
Pale skin				✓			

	ARIMIDEX	AROMASIN	FEMARA	TAMOXIF-EN	EVISTA	FARESTON	FASLODEX
Vaginal discharge/bleeding						✓	
Absent, missed, or irregular menses				✓			
Vision problems	✓			✓		✓	
Blindness				✓		✓	
Dry eyes						✓	
Diarrhea	✓		✓		✓		✓
Sore throat	✓						✓
Back pain	✓	✓	✓	✓			✓
Stomach pain			✓				✓
Injection site pain							✓
Pounding in the ears	✓						
Shortness of breath	✓	✓		✓	✓		✓
Chest tightness/heaviness	✓	✓	✓	✓	✓		✓
Sweating	✓	✓					
Bone fractures		✓	✓				
Difficult, burning, or painful urination		✓		✓	✓		
Bloody/cloudy urine					✓		✓
Loss of balance			✓				
Unusual bleeding/bruising				✓			
Tingling of hands/feet				✓			✓
Leg cramping					✓		

RADIATION

TYPES:

- **External beam radiation (EBR) –** a machine sends high-energy rays directly to the tumor, or if given after surgery has been performed, at the tumor bed, to wipe out any cells left behind. The objective is to destroy the tumor cells with minimal damage to the normal, healthy tissue and organs. On average, clients receive treatment Mon-Fri for 6 weeks. ***Intra-operative radiation*** is external beam radiation given during an operation. It is an experimental treatment being used for cancers of the breast, colon, rectum, stomach, brain, pancreas, and gynecologic organs.
  Radiation therapy kills cancerous cells while they are undergoing cell division. Normal tissue that functions without constant cell reproduction such as muscle, neural, reproductive, and lung tissue, skin, gastrointestinal mucosa, bone marrow, and exocrine glands, is more resistant to damage from radiation. On the other hand, the normal vascular and connective tissues that support muscles and nerves does, in fact, reproduce frequently, making them more susceptible to the effects of radiation. It is important that your clients do not apply lotions or jellies that contain petroleum jelly as they may interfere with treatment or healing. Clients should consult their doctor or nurse for product recommendations. It is also important not to apply anything hot or cold to the affected skin without first consulting the radiation oncologist. Heat or cold may further irritate the already sensitive skin. If your client goes in a swimming pool or salt water, they must rinse their skin well with fresh water. Skin should not be exposed to direct sunlight for at least one month after treatment.

  Other types of external beam radiation include:

  - **Three-dimensional conformal radiation therapy (3D-CRT) –** is one of the most common types of EBR and it uses special computers to map out the exact location of the cancer. The patient is fitted with a plastic mold that resembles a full body cast. The mold will keep them in position so that the radiation can be administered more accurately. Radiation beams coming from several directions are aimed at the target, minimizing the risk of damaging the healthy surrounding tissue. This method seems to be as effective as external beam radiation therapy with less damage to the healthy tissue.

  - **Conformal proton beam radiation therapy –** uses a similar approach to the 3-D conformal radiation. Instead of using x-rays it focuses proton beams on the cancerous cells. Unlike x-rays which release energy both before and after they hit the targeted area, protons cause little damage to tissue because they pass through the tissue and don't release their energy until they have travelled some distance past the target. Proton beam therapy is still in somewhat of a trial phase and not readily available. There are only a handful of these very expensive machines in the U.S. and they may not be covered by insurance at this time.

  - **Intensity-modulated radiation therapy (IMRT) –** may be used to decrease toxicity to normal tissue. IMRT is a type of 3-D radiation therapy that targets tumors with greater precision than conventional radiation therapy. Using highly sophisticated computer software and 3-D images from CT scans, the radiation oncologist can develop an individualized treatment plan that delivers high doses of radiation to cancerous tissue while sparing surrounding organs and reducing the risk of injury to healthy tissues.

  - **Image-guided radiation therapy (IGRT) –** in IGRT, repeated imaging scans (CT, MRI, or PET) are performed during treatment. These imaging scans are processed by computers to identify changes in a tumor's size and location due to treatment and to allow the position of the patient or the planned radiation dose to be adjusted during treatment as needed. Repeated imaging can increase the accuracy of radiation treatment and may allow reductions in the planned volume of tissue to be treated, thereby decreasing the total radiation dose to normal tissue.

- **Tomotherapy –** is a type of image-guided IMRT. A tomotherapy machine is a hybrid between a CT imaging scanner and an external-beam radiation therapy machine. The part of the tomotherapy machine that delivers radiation for both imaging and treatment can rotate completely around the patient in the same manner as a normal CT scanner. Tomotherapy machines can capture CT images of the patient's tumor immediately before treatment sessions, to allow for very precise tumor targeting and sparing of normal tissue. Like standard IMRT, tomotherapy may be better than 3D-CRT at sparing normal tissue from high radiation doses. However, clinical trials comparing 3D-CRT with tomotherapy have not been conducted.

- **Hyperfractionated radiation therapy –** is being used experimentally for advanced lesions of the lip. This procedure administers accelerated doses of external-beam radiation to the cancerous site.

- **Respiratory gating –** is another type of radiation therapy used to treat stomach cancer with minimal damage to healthy tissue. Because tumors and organs in the abdomen shift during breathing, precise delivery of radiation therapy to cancerous tissue can be difficult. Respiratory gating entails the delivery of radiation treatment only at certain points during a patient's breathing cycle, when the "mobile" tumors and/or regions of the abdomen are in a specific position. This approach decreases the radiation dose to the surrounding healthy tissues.

- **Brachytherapy (internal) –** is also called seed implantation or interstitial radiation and it entails surgically implanting a radioactive substance into a body cavity or directly into the tumor. There are two types:

  - **Permanent (low dose rate or LDR) –** seeds of radioactive material are placed inside thin needles which are then inserted into the skin. This is usually done under general anesthesia, or a spinal nerve block. The seeds are left in place and the needles are removed. They give off low dose radiation for weeks, or even months. Because the radiation from the seeds doesn't travel far, they can put out a very large amount of radiation to a very small area. This minimizes damage to the surrounding healthy tissue. After the radioactive material is used up, the seeds are just left in place. Because they are so small they cause little to no discomfort.

  - **Temporary (high dose rate or HDR) –** hollow needles are inserted into the skin and catheters are placed in the needles. The needles are removed, and the catheters stay in place. There may be some pain in the area of placement for about a week. The radioactive substance is placed in the catheters and delivered for 5-15 minutes. Typically, three treatments are given over a couple of days and the radioactive substance is removed every time. After the last treatment the catheters are removed. These treatments are usually combined with external beam radiation however, the external beam radiation is given at a lower dose than if it were given by itself. Once a patient has received radioactive seeds, they will give off a small amount of radiation for several weeks. Although the radiation doesn't travel far, the patient should stay away from pregnant women and small children during that time.

Potential side-effects of HDR and LDR brachytherapy:

- Localized bleeding, bruising, swelling, discharge, and/or discomfort in treated area for a few days after treatment

- Treatment for cervical or prostate cancer can cause urinary retention, incontinence, and painful urination. Increased bowel frequency, diarrhea, constipation, and rectal bleeding may also occur.

- **Stereotactic Radiosurgery –** by definition, SBRT treats tumors that lie outside the brain and spinal cord. Because these tumors are more likely to move with the normal motion of the body, and therefore cannot be targeted as accurately as tumors within the brain or spine, SBRT is usually given in more than one dose by surgically implanting radioactive pellets into the tumor site, a lethal dose of radiation is delivered, minimally affecting nearby brain tissue. This procedure is done by creating a small hole in the skull in which the ***dionuclides*** (pellets) are placed and subsequently removed after 6 or 7 days. Using three-dimensional guidance, the machine sends multiple beams of high-dose radiation to the tumor, blasting it from different angles. Next, the patient is repositioned on the table with a five-hundred-pound helmet containing 201 holes – one for each beam of radiation delivered by the ***gamma knife.*** This procedure seems to be most effective for small primary and metastatic brain tumors that measure less than 4 cm in diameter, and for those tumors that are considered inoperable. ***Prophylactic cranial radiation*** is a palliative form of radiation that may be administered to the brain of small cell lung cancer clients to prevent tumors from forming on the brain.

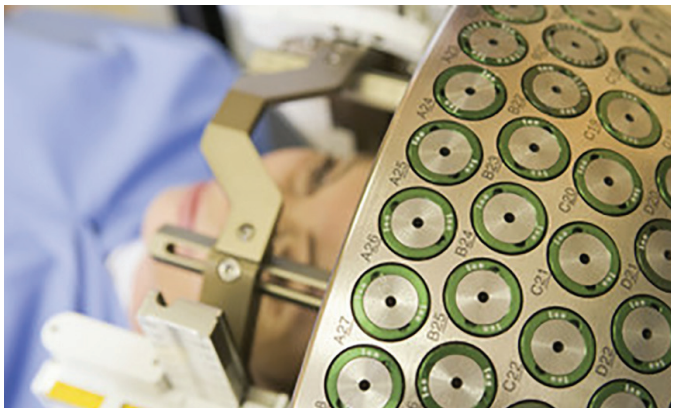
Potential side effect of stereotactic radiosurgery:

- Nausea
- Neck stiffness
- Pain at the pin sites
- Radiation injury to brain tissue surrounding the target that may cause swelling 3-12 months after the procedure. In most cases it is temporary and resolves itself, but some clients may need steroid medications to control persistent swelling.

- **Whole brain and spinal cord radiation therapy (craniospinal radiation) –** if tests find that the tumor has spread along the covering of the spinal cord (meninges), or into the surrounding cerebrospinal fluid, then radiation may be given to the whole brain and spinal cord. Some tumors such as ependymomas and medulloblastomas are more likely to spread this way and often require craniospinal radiation.

Potential side effects of all radiation procedures:

- Damage to normal brain tissue
- Swelling of the brain
- Loss of brain function
- Memory loss
- Personality changes
- Trouble concentrating
- Bleeding
- Nausea
- Vomiting
- Headaches
- Fatigue
- Irritability
- Weakness
- ***Radiation necrosis*** (rarely after radiation therapy, a large mass of dead tissue forms at the site of the tumor. This occurs months to years after radiation is given).



TARGETED THERAPY

Drugs that target the HER2/neu protein - HER2-positive breast cancer is a breast cancer that tests positive for a protein called human epidermal growth factor receptor 2 (HER2), which promotes the growth of cancer cells. In 1 in 5 patients with breast cancer, the cancer cells have too much of this growth-promoting protein on their surface. These breast cancers tend to grow and spread more aggressively without treatment. A number of drugs have been developed that target this protein.

- **Trastuzumab (Herceptin)-** is a type of drug known as a ***monoclonal antibody*** (a man-made version of a very specific immune system protein). It attaches to HER2 and can help slow the growth of cancer cells with too much of the protein. It may also stimulate the immune system to more effectively attack the cancer. Trastuzumab is given as an injection into a vein (IV), usually once a week or as a larger dose every 3 weeks. Treatment that combines trastuzumab with chemotherapy generally works better than chemotherapy alone.
  Possible side effects of Trastuzumab (Herceptin):
  - Fever and chills
  - Weakness
  - Nausea
  - Vomiting
  - Cough
  - Diarrhea
  - Headache

- **Heart damage that may lead to congestive heart failure (symptoms include shortness of breath, leg swelling, and severe fatigue – client should see doctor immediately).**

- **Ado-trastuzumab emtansine (TDM-1, Kadcyla) -** is a type of drug known as an antibody-drug conjugate. It is made up of the same monoclonal antibody found in trastuzumab attached to a chemo drug known as DM-1. In this type of drug, the antibody takes the chemotherapy drug directly to the cancer cells. This drug is given by itself (without chemo) to treat advanced breast cancer. It is given as an injection into a vein every 3 weeks.
  Possible side effects of Ado-trastuzumab emtansine (TDM-1, Kadcyla):
  - Fatigue
  - Nausea
  - Muscle and bone pain
  - Low platelet counts
  - Headache
  - Constipation
  - Severe allergic reactions
  - Liver damage
  - Heart damage
  - Lung problems

- **Pertuzumab (Perjeta)-** is a monoclonal antibody that attaches to the HER2 protein. It seems to target a different part of the protein than trastuzumab does. This drug is used to treat advanced breast cancer, often along with docetaxel (Taxotere) and trastuzumab. This drug is given as an infusion into a vein every 3 weeks.

  Possible side effects of Pertuzumab (Perjeta) when given with trastuzumab and docetaxel:

  - Diarrhea
  - Hair loss
  - Nausea
  - Fatigue
  - Rash
  - Low white blood cell counts
  - Fever

- **Lapatinib (Tykerb) -** is another drug that targets the HER2 protein. It is given as a pill for women with advanced HER2-positive breast cancer that no longer benefits from chemotherapy and trastuzumab. The chemo drug capecitabine (Xeloda) is often given in combination with lapatinib to treat metastatic breast cancer. It may also be given with letrozole (Femara) in patients with HER2-positive advanced breast cancer that is also ER-positive.

  Possible side effects of Lapatinib (Tykerb):

  - Diarrhea
  - Nausea
  - Vomiting
  - Rash
  - Hand-foot syndrome
  - Liver problems or a decrease in heart function (rare)

- **Everolimus (Afinitor) -** is a type of targeted therapy that blocks mTOR, a protein in cells that normally promotes their growth and division. By blocking this protein, everolimus can help stop cancer cells from growing. Everolimus may also stop tumors from developing new blood vessels, which can help limit their growth. In treating breast cancer, this drug seems to make hormone therapy drugs more effective. It is approved to treat advanced hormone receptor–positive, HER2–negative, breast cancer in post-menopausal women.

  Possible side-effects of Everolimus (Afinitor):

  - Mouth sores
  - Diarrhea
  - Nausea
  - Fatigue
  - Feeling weak or tired
  - Low blood counts
  - Shortness of breath
  - Cough
  - Increase cholesterol, triglycerides, and blood
  - Increased risk of serious infections

- **Bevacizumab (Avastin) -** is a monoclonal antibody that has been used in patients with metastatic breast cancer. This antibody is directed against vascular endothelial growth factor, a protein that helps tumors form new blood vessels.

  Possible side effects of Bevacizumab (Avastin):

  - Bleeding
  - Holes forming in the colon (requiring surgery to correct)
  - Slow wound healing
  - High blood pressure
  - Tiredness
  - Blood clots
  - Low white blood cell counts
  - Headaches
  - Mouth sores
  - Loss of appetite
  - Diarrhea

CHAPTER FOUR

EXERCISE AND CANCER

Objective: to understand the many benefits of exercise in preventing cancer, minimizing treatment side-effects, speeding recovery, and increasing life expectancy.

- Strength training
- Aerobic training
- Flexibility training
- Functional training

Goal: to understand how exercise plays a profound role in overall health as well as the prevention of cancer comorbidities and future cancers.

BENEFITS OF EXERCISE IN PREVENTING CANCER

The American Cancer Society recommendations for physical activity include the following:

- Adults should get at least 150 minutes of moderate intensity or 75 minutes of vigorous intensity activity each week (or a combination of these), preferably spread throughout the week [181]
- Children and teens should get at least 1 hour of moderate or vigorous intensity activity each day, with vigorous activity on at least 3 days each week [181]
- Limit sedentary behavior such as sitting, lying down, watching TV, and other forms of screen-based entertainment [181]
- Doing some physical activity above usual activities, no matter what one's level of activity, can have many health benefits [181]

Exercise has many proven health benefits for both preventing disease and promoting health and wellbeing [181]. There is substantial evidence that suggests that increasing physical activity, including structured exercise programs, is associated with lower rates of certain cancers [181]. In particular, there is evidence that high levels of physical activity can work to prevent colon cancer [89,93]. Cancers of the breast, prostate, lung, and uterus have also been linked to exercise-related prevention [89,93].

In a large-scale study of 17,148 Harvard alumni, men who burned as few as 500 calories a week in exercise - the equivalent of an hour's worth of brisk walking or less than ten minutes of waking a day - had death rates 15-20 percent lower than men who were almost completely sedentary [89,93]. Men who burned 2,000 calories a week (about four hours of brisk walking per week) had about 35 percent lower cancer mortality [89,93]. The researchers concluded that the more exercise you get, the lower your risk of premature death from cancer or heart disease [89,93]. The Harvard study also found that the risk of colon cancer, the second leading cause of cancer-related death in the U.S., was dramatically reduced by exercise [89,93]. Prostate cancer is the most common cancer affecting men today [31,89,93]. In the Harvard study, alumni who expended greater than 4,000 calories per week (equivalent to about eight hours of brisk walking) were at a reduced risk of developing prostate cancer compared to their inactive counterparts [89,93].

According to the American Cancer Society, for the great majority of Americans who do not smoke cigarettes, dietary choices and physical activity are the most important modifiable determinants of cancer risk [181]. Evidence suggests that one third of the more than 500,000 cancer deaths that occur in the United States each year can be attributed to diet and physical activity habits, with another third due to cigarette smoking [89,93].

A new study of the relationship between physical activity and cancer has shown that greater levels of leisure-time physical activity were associated with a lower risk of developing 13 different types of cancer [54,89]. The risk of developing seven cancer types was 20 percent (or more) lower among the most active participants (90th percentile of activity) as compared with the least active participants (10th percentile of activity) [54,89]. These findings, from researchers at the National Cancer Institute (NCI), part of the National Institutes of Health, and the American Cancer Society, confirm and extend the evidence for a benefit of physical activity on cancer risk and support its role as a key component of population-wide cancer prevention and control efforts. The study, by Steven C. Moore, Ph.D., NCI, and colleagues, appeared May 16, 2016, in JAMA Internal Medicine [149,151].

This new study pooled data on 1.44 million people, ages 19 to 98, from the United States and Europe, and was able to examine a broad range of cancers, including rare malignancies [149,151]. Participants were followed for a median of 11 years during which 187,000 new cases of cancer occurred [149,151].

The investigators confirmed that leisure-time physical activity, as assessed by self-reported surveys, was associated with a lower risk of colon, breast, and endometrial cancers [149,151]. They also determined that leisure-time physical activity was associated with a lower risk of 10 additional cancers, with the greatest risk reductions for esophageal adenocarcinoma, liver cancer, cancer of the gastric cardia, kidney cancer, and myeloid leukemia [149,151]. Myeloma and cancers of the head and neck, rectum, and bladder also showed reduced risks that were significant, but not as strong [149,151]. Risk was reduced for lung cancer, but only for current and former smokers; the reasons for this are still being studied [149,151]. Leisure-time physical activity is defined as exercise done at one's own discretion, often to improve or maintain fitness or health. Examples include walking, running, swimming, and other moderate to vigorous intensity activities. The median level of activity in the study was about 150 minutes of moderate-intensity activity per week, which is comparable to the current recommended minimum level of physical activity for the U.S. population [149,151].

There are several mechanisms through which physical activity could affect cancer risk [172]. It has been hypothesized that cancer growth could be initiated or abetted by three metabolic pathways that are also affected by exercise: sex steroids (estrogens and androgens); insulin and insulin-like growth factors; and proteins involved with both insulin metabolism and inflammation [172]. Additionally, several non-hormonal mechanisms have been hypothesized to link physical activity to cancer risk, including inflammation, immune function, oxidative stress, and, for colon cancer, a reduction in time that it takes for waste to pass through the gastrointestinal tract [172].

Most associations between physical activity and lower cancer risk changed little when adjusted for body mass index, suggesting that physical activity acts through mechanisms other than lowering body weight to reduce cancer risk [172]. Associations between physical activity and cancer were also similar in subgroups of normal weight and overweight participants, and in current smokers or people who never smoked [172]. The study was a large-scale effort of the Physical Activity Collaboration of NCI's Cohort Consortium, which was formed to estimate physical activity and disease associations using pooled prospective data and a standardized analytical approach.

Moore SC, et al. Leisure-time physical activity and risk of 26 types of cancer in 1.44 million adults. JAMA Internal Medicine. May 16, 2016. DOI:10.1001/jamainternmed.2016.1548.

A 2019 study by ***Ferioli M, Zauli G, Maiorano P, Milani D, Mirandola P, and Neri LM - Role of physical exercise in the regulation of epigenetic mechanisms in inflammation, cancer, neurodegenerative diseases, and aging process - 2019 Feb 14. doi: 10.1002/jcp.28304. [Epub ahead of print],*** confirms that the modulation of epigenetic processes by physical exercise positively influences prevention, development, and the course of inflammatory and cancer diseases, as well as neurodegenerative illnesses.

Positive associations were observed between adult BMI and postmenopausal **breast cancer** in numerous studies (relative risk, approximately 1.1 per 5 BMI units), particularly for estrogen-receptor–positive tumors. Waist circumference and body-weight gain in adulthood were positively associated with the risk of postmenopausal breast cancer [4]. For premenopausal breast cancer, consistent inverse associations were observed between BMI and risk [151].

The association between BMI and **endometrial cancer** was particularly pronounced for type 1 endometrial cancer [151]. There was a strong dose–response relationship, with relative risks of approximately 1.5 for overweight, 2.5 for class 1 obesity, 4.5 for class 2 obesity, and 7.1 for class 3 obesity [151]. A modest positive association was observed for epithelial ovarian cancer, with a relative risk of 1.1 [151].

For **multiple myeloma,** the available data showed positive associations with adult BMI, with relative risks of approximately 1.2 for overweight, 1.2 for class 1 obesity, and 1.5 for class 2 or 3 obesity [151]. On the basis of several cohort or case–control studies, a positive association was observed between BMI and the risk of **meningioma** and **thyroid cancer** [151].

In a study by ***Joy Shi, Lindsay C. Kobayashi, Anne Grundy, Harriet Richardson, Sandip K. SenGupta, Caroline A. Lohrisch, John J. Spinelli, and Kristan J. Aronson - Lifetime moderate-to-vigorous physical activity and ER/PR/HER-defined post-menopausal breast cancer risk - Breast Cancer Research and Treatment, August 2017, Volume 165, Issue 1, pp 201–213,*** authors conducted an assessment of vigorous physical activity (MVPA) in leisure-time, household, and occupational domains across the total lifetime and in four age periods with breast cancer risk, as defined by estrogen receptor (ER)/progesterone receptor (PR) status and ER/PR/human epidermal growth factor-2 (HER2) status, among post-menopausal women.

Data was collected from 692 women with incident breast cancer and 644 controls in the Canadian Breast Cancer Study, a case–control study of women aged 40–80 years in British Columbia and Ontario. Total lifetime leisure-time MVPA was associated with reduced risk of **ER−/PR− breast cancer** in a dose–response fashion. In contrast, total lifetime household MVPA was associated with reduced risk of ER+ and/or PR+ breast cancer. When further stratified by HER2 status, the effect of leisure-time MVPA appeared confined to HER2− breast cancers, and the effect of household MVPA did not differ according to HER2 status. Similar trends were observed when stratified by age period.

For women, a history of moderate, recreational exercise is associated with reduced risk of breast, uterine, cervical, and ovarian cancers, although not all studies have shown this effect [151]. Currently, scientists are studying the biological impact that exercise has on the risk of cancer. Some of the methods that are being studied include [151]:

- Maintenance of a healthy body weight and overall amounts of body fat
- Maintenance of low levels of fat in and around the abdomen
- Maintenance of the biological system that regulates blood sugar levels
- Control of some tumor growth factors
- Suppression of 'prostaglandins' (hormone-like substances that are released in greater quantities by tumor cells)
- Improved immune function, including increased levels of Natural Killer cells
- Reduced symptoms of mild to moderate anxiety and depression (which may improve immune function and overall physiologic functioning)
- Increased levels of free radical scavengers to assist the body in preventing DNA damage

It is not clear exactly how high amounts of physical activity work to prevent cancer. We know that exercise can help prevent obesity, which is related to some types of cancers [151]. It can also change the body's hormone levels, which might also have a favorable effect [151]. Exercise, by speeding up metabolism, is generally believed to speed up the passage of ingested foods through the colon – thus reducing the amount of time the colon mucosal lining is in contact with possible carcinogens [151]. Additionally, those who engage in a high level of physical activity are much less likely to smoke cigarettes, the single largest contributor to cancer [151].

BENEFITS OF EXERCISE DURING TREATMENT

Starting or maintaining an exercise program after cancer diagnosis results in clients who are stronger both mentally and physically, concludes a statistical analysis of 24 studies. Kerry Courneya of the University of Alberta, Canada led the research, which is published in the Annals of Behavioral Medicine [123]. Courneya says "Cancer diagnosis and its' treatments are often associated with negative side effects that diminish the quality of life [123]. Overall, studies have consistently demonstrated that physical exercise following cancer diagnosis has a positive effect on the quality of life." [123]

In a growing body of research that has investigated exercise in cancer patients; dramatic improvements in physiologic and psychological functioning have been documented in patients participating in exercise programs [31, 23,151]. Evidence of the benefits of exercise for cancer survivors in areas of psychological and quality of life (QOL) outcomes, cancer related fatigue, physical functioning, body weight and composition, muscle strength and endurance, immune function, and cardiovascular fitness have been reported [31, 23,151]. Exercise may also alleviate symptoms that interfere with daily life of cancer patients and survivors such as lack of appetite, diarrhea, paresthesia, constipation, physical fatigue, mental fatigue, treatment related fatigue, muscle pain, arthralgia and other pain, depression, anxiety and insomnia according to the following studies: ***Winningham ML, MacVicar MG, Bondoc M, Anderson JI, Minton JP. Effect of aerobic exercise on body weight and composition in patients with breast cancer on adjuvant chemotherapy. Oncol Nurs Forum.1989;16:683–9. Courneya KS, Friedenreich CM, Sela RA, Quinney HA, Rhodes RE, Handman M. The group psychotherapy and home-based physical exercise (Group-Hope) trial in cancer survivors: Physical fitness and quality of life outcomes. Psychooncology. 2003;12:357–74. Andersen C, Adamsen L, Moeller T, Midtgaard J, Quist M, Tveteraas A, et al. The effect of a multidimensional exercise programme on symptoms and side effects in cancer patients undergoing chemotherapy, The use of semi-structural diaries. Eur J Oncol Nurs. 2006;10:247–62.***

In addition, various studies mention increased stamina, functional capacity, and strength, improved self-esteem, self-confidence, treatment tolerance, satisfaction with life, and decreased pain [25]. Psychological changes, including a decrease in total mood disturbances, decrease in depression, and fewer problems sleeping were noted between the exercise and non-exercise groups [25]. The specific exercise "dose" (frequency, intensity, and duration of sessions) needed to improve physical and psychological functioning in cancer clients probably differs according to specific treatment, cancer type, and individual response to treatment [25]. Some forms of cancer treatment, particularly those that are used to treat childhood cancers, have been found to have long-term negative effects on the heart and lungs [106,143]. This makes it even more important to exercise regularly, but it may important to do so under medical supervision [106,143].

In a second study, ***Abstract 1480P_PR 'Effects of physical exercise in non-operable lung cancer patients undergoing palliative treatment'.*** Annals of Oncology, Volume 29 Supplement 8 October 2018, of 227 patients with advanced or metastatic lung cancer, those who did regular easy aerobic and muscle strengthening exercises improved their symptom scores by approximately 10% during chemotherapy. "This is the first time that patients undergoing palliative care for lung cancer have been shown to benefit from exercise. Patients who exercised also felt more independent and needed less help with daily activities, and our research suggested that they may be able to have more and longer chemotherapy which, in turn, may result in better tumor control," explained Dr. Joachim Wiskemann, Exercise Physiologist and Sports Psychologist, National Center for Tumor Diseases (NCT) and Heidelberg University Hospital, Heidelberg, Germany.

Wiskemann estimated that 50-60% of patients with advanced lung cancer are willing and able to exercise and recommends adapting the nature and setting for exercise to individual needs [184]. He also stressed the importance of coordinated care with good commitment from oncologists and cancer nurses and a specific individual responsible for counselling and delivery of tailored exercise programs for patients [184].

Dr. Martijn Stuiver, Associate Professor of Functional Recovery from Cancer and its Treatment at the Amsterdam University of Applied Sciences, the Netherlands, pointed out that the Clinical Oncology Society of Australia already recommends that exercise should be part of standard cancer care [92] and he stresses the importance of greater awareness of the benefits of exercise, including in advanced cancer. "Physical fitness is a key factor in determining whether patients can start treatment and maintain dosing. Exercise may therefore become a primary adjuvant therapy to improve fitness so that patients are in the best possible shape to start or continue treatment and tolerate toxicities of other therapies."

BENEFITS OF EXERCISE DURING RECOVERY FROM SURGERY

After cancer surgery exercise plays an invaluable role in helping one return to the strength and fitness level that was maintained prior to surgery. In many cases, due to lack of physical activity prior to surgery, clients can reach new heights in strength, flexibility, and cardiovascular conditioning. There are certain postural implications that often arise after mastectomy and lymph node dissection that are often compounded by reconstruction and radiation. After years of working with cancer survivors, we declare with certainty that most of these issues can be dramatically improved upon if not entirely corrected, through the proper combination of stretching and strengthening. Anytime there is an amputation, it will ultimately result in some type of muscle imbalance. These issues will not correct themselves. Unfortunately, even clients who undergo physical therapy are released long before they are fully recovered, leaving the patient to go it alone in determining how to resume normal activities. In addition, when clients receive radiation to a particular area, there is bound to be some tightness, perhaps even scar tissue, where they received treatment. This can cause tightening in that area, and depending on where it is, can also contribute to many postural deviations. These postural imbalances are notable in most people due to everyday circumstances i.e.; working at a computer all day, holding a phone between your ear and your shoulder, sitting at a desk all day, holding a baby on one hip etc. Not only are they compounded by the surgery and radiation, but they can create a chain reaction, leading to neck, back, hip, knee, and even ankle pain. A thorough postural assessment can determine what areas need to be stretched to relieve tightness and spasm and which need to be strengthened to create a counter balance.

Let's not forget about the many benefits of cardiovascular conditioning. Many of your clients may still be suffering from fatigue long after their treatment has ended. Cardiovascular training, biking, walking, running, etc., will produce endorphins that will give them much needed energy.

Unfortunately, chemotherapy and radiation can have a detrimental effect on the heart and lungs [100,143]. The good news is that both can be strengthened through a regular cardiovascular exercise program. Swimming can provide an excellent source of relief for tight muscles without putting excessive strain on them. The buoyancy of the water allows for a wonderful workout that allows clients to focus on range of motion for their arms and shoulders. This is highly recommended for breast cancer clients, particularly those who have undergone an axillary node dissection [129,144]. Swimming should not be limited only to breast cancer clients, however, for it has benefits for everyone. Swimming may even have a "leg-up" on cardio workouts in that it has built-in strength training benefits and works several muscle groups at once. Those clients suffering from arthritis will want to make sure the water is at least eighty degrees [185]. If your client has a catheter or feeding tube or compromised immune system (chemotherapy/splenectomy/radiation) they should avoid public swimming pools and hot tubs, lake, or ocean water and other exposures that may cause infections [187]. For those undergoing radiation treatment, chlorine may irritate the skin over the treatment area [186]. A disinfected private swimming pool can provide a viable option [187].

PEACE: an organizational model for examining when and how physical exercise may affect the cancer experience. [Adapted from Courneya K.S, Friedenreich C.M.2], suggests that physical activity may help cancer survivors live longer by reducing the risk of cancer recurrence or slowing cancer progression and reducing the risk of other life-threatening diseases including second primary cancers. The results generally show that the higher physical activity is associated with lower rate of breast and colon cancer recurrences, cancer specific mortality and all causes of mortality.

Exercise during treatment for **breast or colon cancer** has multiple benefits, including reduced fatigue and improved ability to remain physically active over the long term, according to a study presented at the February 2018 Cancer Survivorship Symposium. Anne M. May, PhD, of University Medical Center Utrecht in the Netherlands - "It is well known that exercise during chemotherapy can lessen treatment-related side effects, such as fatigue, pain and nausea."

The Dutch PACT study [188] investigated whether exercise during chemotherapy can reduce treatment-related side effects. Following surgery for stage I-III breast or colon cancer, study participants were randomly assigned to participate in an 18-week supervised exercise program or receive usual care while they were receiving chemotherapy (about 70% of patients also received radiation therapy) [188]. The exercise intervention involved 60 minutes of combined moderate- to high-intensity aerobic and strength training twice a week under the supervision of a physical therapist, plus 30 minutes of home-based physical activity three days a week. Researchers previously reported that the exercise program was effective in the short-term – patients who exercised during treatment had less fatigue than those who did not [188].

Four years later, researchers surveyed 128 of the study participants (110 with breast cancer and 18 with colon cancer) to determine if the exercise intervention had long-term benefits. After four years, patients in the exercise group reported engaging in moderate-to-vigorous physical activity, such as cycling or jogging, 90 minutes a day, on average, whereas those in the usual care group reported 70 minutes of moderate-to-vigorous physical activity per day [188]. There was also a trend of lower physical fatigue in the exercise group compared to the usual care group, but the difference was not statistically significant [188].

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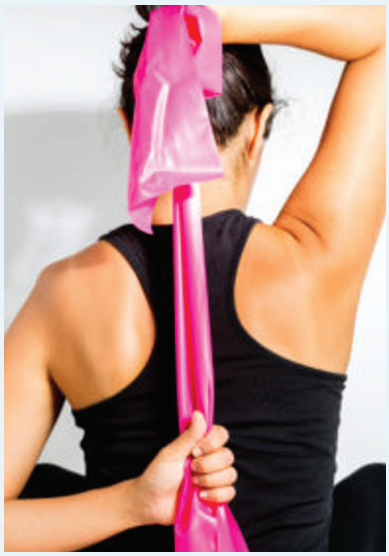
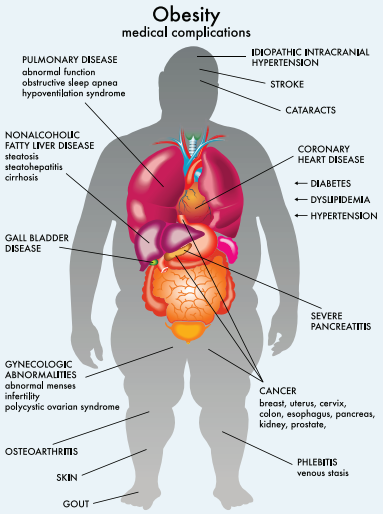
During treatment, or anytime the immune system is compromised, swimming should be avoided. Chlorinated pools or Jacuzzis are also to be avoided by those with radiation burns.

STRENGTH TRAINING



Strength training is a very important component of an exercise program, however, without a proper assessment, it can create more problems than it can prevent. Proper attention must be paid to not only to the goals you have set with your client, but also to their bodies' immediate needs. This can be accomplished by conducting a postural evaluation to look for muscle imbalances that may lead to degeneration of the joints over time. It is critical to determine which muscles are shortened, or overly tight, so that proper attention can be paid to stretching those muscles first. This will help your client to regain normal range of motion and functioning. If your client begins strength training before addressing the muscular imbalance, it can lead to a greater imbalance and degeneration. Done properly however, strength training can lead to an increase in lean muscle mass which will not only give a desirable physical appearance, it can help to prevent obesity and osteoporosis.



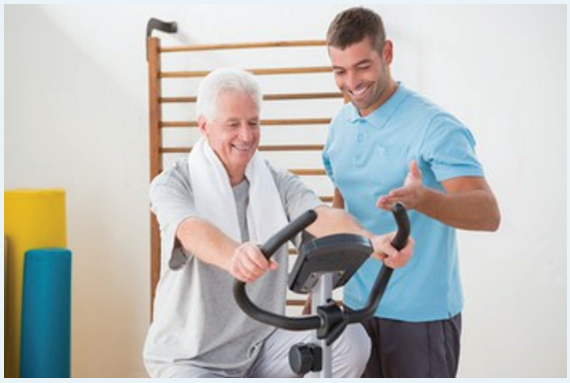
Obesity is the fastest growing health problem in the United States. Obesity is not only associated with other diseases, it has a huge emotional impact as well. There is distinct connection between obesity and Type II diabetes. This is of particular concern when dealing with cancer patients. Following chemotherapy and certain hormonal therapies, many cancer patients find themselves gaining weight. Many were over their ideal weight to begin with are now struggling with a serious weight problem in addition to their cancer diagnosis. Obesity is not only connected to Type II diabetes, it is also thought to be associated with certain types of cancer, yet another compelling reason to start exercising, eating right, and losing weight.

For those of your clients who have undergone a lymph node dissection, or radiation to the lymph nodes and vessels, they are now at risk for lymphedema. Lymphedema is the swelling of an area do to damage to, radiation, or removal of lymph nodes and vessels. It is usually a permanent and irreversible condition that is both painful and disfiguring. Having an excess amount of body fat can actually increase their risk of lymphedema because the fatty tissue retains fluid. Both men and women who are undergoing hormonal therapy are at risk for osteoporosis. This risk is magnified if they have also undergone chemotherapy. The good news is that strength training can help to reduce body fat by increasing lean muscle mass, increase bone density and prevent osteoporosis, and prevent and/or manage Type II diabetes.

In summary, the benefits of strength training:

- Increase lean muscle mass; better physical appearance, higher metabolism, less body fat
- Reduces the risk of Type II diabetes and lymphedema by reducing the amount of body fat
- Reduces the risk of osteoporosis by increasing bone mass
- Look and feel better
- Increased self-confidence

AEROBIC TRAINING



Aerobic training is exercise that places a stress on the cardiorespiratory system. Any form of activity can be used; walking, biking, basketball, strength training, etc. All forms of exercise must utilize the cardiorespiratory system to sustain and recuperate from the activity. Many people who have undergone chemotherapy and radiation may have damage and scarring of the heart and/or lungs.

Aerobic exercise can help to strengthen the heart and lungs, minimizing the amount of damage they will sustain. As with strength training, aerobic exercise helps one to maintain their ideal body weight thereby reducing the risk for diabetes, future cancers associated with obesity, heart disease, high blood pressure, high cholesterol, and lymphedema. It is critical to perform a warm-up to prepare the body for physical activity.

There are two types of warm-ups; general and specific. A general warm-up consists of movements that are not specific to the activity to be performed. A specific warm-up more closely imitates movements form the actual activity. NASM suggests that the cardiorespiratory portion of a warm-up should be five to ten minutes long at a low-to-moderate intensity. On a scale of 1-10, 1 being bed rest and 10 being all out exertion, aim for a five! If you don't have an exercise machine, climb stairs, march in place, walk around the block, shoot some hoops, etc.

When your client is ready to continue their aerobic exercise beyond five to ten minutes, have them slowly begin to add time and intensity. Remember that this is general advice. If they have a heart condition, high blood pressure, have had a stroke, or any other special consideration, please instruct them to consult with their doctor for specific recommendations. Additionally, if they have had lymph nodes removed or had radiation to lymph nodes or lymphatic vessels they should try to avoid overheating. Overheating will increase their circulation and can lead to the onset of lymphedema. If they already have lymphedema, the same rule applies because it can worsen the condition. If they have not been exercising regularly, set a goal of 10-20 minutes of aerobic activity three times a week (slowly building up to that). Gradually increase the time (duration) and number of workouts (frequency) to meet their goals.

In summary, the benefits of aerobic training:

- Increase lean muscle mass
- Better physical appearance
- Higher metabolism
- Increased energy levels
- Less body fat
- Reduces the risk of Type II diabetes and lymphedema by reducing the amount of body fat
- Reduce the risk of heart disease, high blood pressure, and high cholesterol
- Improved self-confidence and self-esteem

FLEXIBILITY TRAINING

Flexibility is overlooked by most of us. Lack of flexibility may lead to long-term joint degeneration, overuse injuries, and muscle imbalances. By definition, flexibility is the extensibility (ability to lengthen) of all soft tissues that allow a joint to move within its full range of motion. The muscular, skeletal, and nervous systems make up the kinetic chain. The kinetic chain must be aligned properly to prevent patterns of joint dysfunction.

When things are not properly aligned, it is known as postural distortion. Postural distortion leads to decreased neuromuscular efficiency and tissue overload. In layman's' terms, injury! Our primary goal needs to be to maintain homeostasis of one's kinetic chain. Imagine a chain link fence. Your dog scurries his way underneath the fence for years. You think nothing of it. Gradually the fence becomes distorted; some of the links are squashed together, the metal is buckling, there is a big gap in the bottom, its' structural integrity is weakened. Now imagine the same thing happening to your spine. It may not be noticeable now, but over the course of time it, too, will deteriorate and weaken.

Muscle imbalances may be caused by a variety of external and internal influences; poor posture, emotional stress, repetitive movements (tennis, golf, bowling, etc.), cumulative trauma, poor training technique and form, lack of core (abdominals and low back) strength, and lack of neuromuscular control. Following surgery and radiation, there is usually a foreseeable amount of scar tissue and, in some cases, adhesions that can bind the joint and inhibit movement. This would fall under the trauma category. If these issues are not corrected, your client will find themselves stuck in a cumulative injury cycle. When there is a dysfunction in the connective tissues of the kinetic chain, the body views it as an injury. As a result, the body will initiate the repair process.

Remember that although beneficial in many ways, strength training creates trauma to the tissue which will then lead to inflammation. The bodies' protective mechanism will increase muscle tension and cause a muscle spasm. As a result of the spasm, adhesions (knots) begin to form in the soft tissue. The adhesions make the normally elastic soft tissue unable to stretch. The end result is muscle imbalance and altered joint motion. If this is not corrected, the adhesions can begin to form permanent structural changes in the soft tissue.

In summary, benefits of flexibility training:

- Increase range of motion in joint movements
- Injury prevention
- May help to prevent arthritis and other degenerative joint disorders
- Eliminates neck, shoulder, back, hip, knee, ankle, and other associated pains
- Helps one to perform activities of daily living (ADL's)
- Increases self-confidence

FUNCTIONAL TRAINING

Functional fitness is the ability to perform one's activities of daily living free of pain and with a relative degree of ease. Most of us take this one for granted, at least until it's gone! Every day we awake from bed, use the bathroom, take a shower, brush your teeth, blow dry your hair, put on your underwear, put on your clothes, put on and tie your shoes, etc. Did it ever occur to you that if you had an injury, or a muscle imbalance, it could become relatively impossible to perform one of these otherwise mundane tasks? Well, it's true! In a perfect world we would sit up straight in our chairs, walk with our shoulders back, not carry a heavy briefcase or bag on one shoulder, bend our knees when we bend to pick something up, and so on and so on. Unfortunately, because we live in a less-than-perfect world, most of us have not practiced these methods of self -preservation and are now experiencing the aftermath of our poor decisions; pain.

Your client may have been suffering with chronic neck and back pain for years, or they may be new to the game and just beginning to get aches and pains. In either case, flexibility training is the answer for them. Believe it or not, most of these nagging aches and pains are reversible with proper corrective training. Corrective training is a balance of strength training and flexibility training that is customized to meet one's particular needs. Following the personal assessment, you will be able to identify the areas that need stretching as well as those that need strengthening. There are several different types of stretching; self-myofacial release, static, dynamic, PNF, and AIS stretching. Each of these methods is described below.

- **Self-myofacial release -** using a foam roller, have your client apply gentle pressure to an adhesion or "knot" for 20-30 seconds. The force that is applied stimulates a relaxation response. This technique is recommended prior to static stretching, as well as during the cool down. Be extremely careful before trying this on a client who has recently had surgery; allow for proper healing time. Instruct them not to use the foam roller on an area in which they have had lymph nodes removed or irradiated as this may increase their risk of lymphedema in that area by restricting blood blow.

- **Static stretching -** this is the most popular form of stretching. In this method your client will passively take a muscle to the point of tension and hold it there for 15-30 seconds. This will stimulate a relaxation response. This method should be used following self-myofacial release and as part of a cool down.

- **Dynamic stretching -** dynamic stretching uses the force produced by a muscle, along with the body's momentum, to take a joint to the full available range of motion. Rather than hold a stretch for 15-30 seconds, one can perform a set of ten repetitions of dynamic stretches. This is a more advanced method of stretching that can also be used as a warm-up prior to activity. It is recommended that your client have good levels of flexibility, core stability, and balance capabilities prior to engaging in a dynamic stretching program.

- **PNF stretching (proprioceptive neuromuscular facilitation) -** this method is also referred to the contract/relax method. It should only be utilized by the experienced BCRBS that is confident in their abilities to perform such stretches safely and effectively. The BCRBS must be careful not to overstretch their client; which could potentially lead to injuries. PNF stretching should be performed after some sort of warm-up and never when your muscles are cold. Significant gains in flexibility are usually made after exercise once the muscles have been warmed up and have been put through some sort of physical activity. The BCRBS moves the client into an initial passive stretch. The client then applies force (isometric contraction) against the BCRBS for 10-15 seconds and then the client is instructed to relax for 20-30 seconds. As the client relaxes, the BCRBS moves immediately into a deeper passive stretch. After another period of relaxations, this process can be repeated again. Make sure that you are reminding the client to "breathe into their stretch."

- **Active Isolated stretching (AIS) -** Aaron Mattes, the creator of AIS stretching, believes that prolonged static stretching actually decreases the blood flow within the tissue creating localized ischemia and lactic acid buildup. This can potentially cause irritation or injury of local muscular, tendinous, lymphatic, as well as neural tissues, similar to the effects and consequences of trauma and overuse syndromes. With AIS, the client stretches themselves as far as they can - comfortably. The BCRBS then "assists" them to stretch a slight degree further (the client may also use a stretching strap to perform the AIS on themselves.

  Identify the muscle to be stretched. Isolate the muscle by positioning into its most relaxed state. Have the client initiate the contraction of that muscle, guiding it through its proper plane, monitoring for relaxation of the opposing antagonist muscle. As the patient contracts the muscle through its proper plane at the endpoint of voluntary contraction, provide a gentle stretch within the same fascial plane to the next endpoint as well as providing a controlled movement back within that same fascial plane. The importance of optimizing full flexibility is that at the end of voluntary muscle movement the gradual extension of the stretch by the BCRBS, from that point towards endpoint and return, should be no longer than 3 seconds. Each motion should return back to the isolated muscles neutral or relaxed state position. The same technique is then repeated anywhere from eight to ten times having each subsequent facilitated stretch achieve an incremental gain in degrees of range of motion. This lengthening with a gentle pressure at end range will microscopically loosen scar tissue and allow restoration of proper muscle length. The result is return back of normal range of motion and alleviation of pain. Once full flexibility is achieved, strengthening can proceed to protect the muscle from re-injury or return of the contracture.

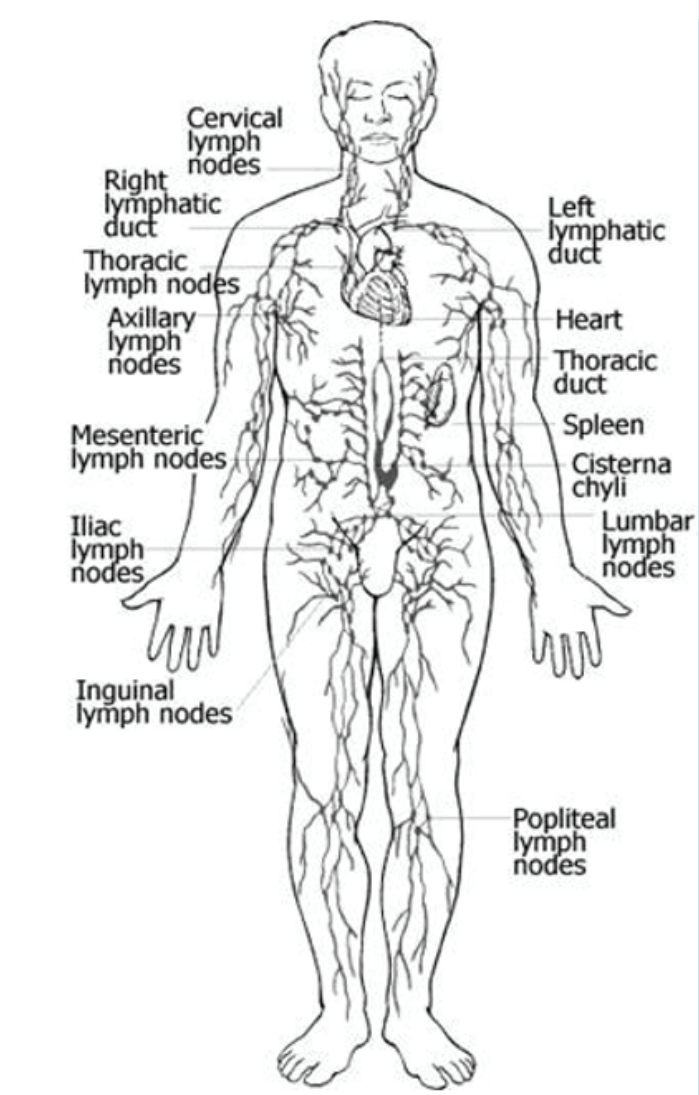
CHAPTER FIVE

LYMPHEDEMA IDENTIFICATION, PREVENTION, AND MANAGEMENT

Objective: to determine a baseline measurement of area(s) that is/are at risk for lymphedema and to educate client on ways to prevent, identify, and manage lymphedema. To gain an understanding of**:**

- The flow of lymphatic fluid
- Risk factors for lymphedema
- Exercises that will promote upper & lower extremity lymph drainage

Goal: to incorporate lymph drainage exercises into client programming and educate client how to start and progress slowly while being aware of early signs of lymphedema.



LYMPHEDEMA

Lymphedema is swelling produced by an accumulation of lymph fluid in the tissue. For breast cancer clients, the swelling occurs in the arm of the affected side due to damage to the lymph vessels in the armpit area caused by the removal of the axillary lymph nodes or from radiation to that area. For prostate cancer, or other lower extremity cancers, the swelling can take place in the abdomen, pelvis, or in either leg or foot. The job of the lymphatic vessels is to drain fluid from the tissue cells in the body, along with protein molecules, bacteria, cellular waste products, and other unusable matter. This protein-rich fluid, called lymph once it is in the lymphatic system, travels in one direction: toward the heart. It is transported through the lymphatic vessels to the lymph nodes, where it is filtered and cleansed before returning to the venous system and moving on to the heart. In the heart, the fluid is simply returned to the blood to be recirculated by the body.

If the lymphatic system has been injured, as in the case of lymph node dissection or radiotherapy (for all types of cancer), the lymph can become backed up. If untreated, the backed-up fluid can provide a breeding ground for bacteria that can result in infection and can delay wound healing. A long-term accumulation of this fluid eventually results in thick and hardened tissues (fibrosis), which creates further resistance to draining the fluid from the limb. While lymphedema may not occur immediately after surgery, it can occur at any time during the client/patient's life after cancer treatment. Sometimes extensive trauma can be the contributing factor while at other times it may be due to a bug bite, cat scratch, or burn.

Radiotherapy also increases the chance of developing lymphedema. Radiotherapy is generally recommended to clients with a high risk of recurrence of cancer, such as those who have large, aggressive tumors. It is also recommended for those whose lymph nodes test positive for cancer cells or show an incidence of microscopic residual disease after surgery. Because lymph nodes are radiosensitive, radiotherapy depletes the lymphocytes in the nodes and decreases their filtering function and immune function. Lymphedema can only affect the arm where the nodes have been irradiated, not the overall immune system. After radiotherapy, the nodes become scarred and fibrotic, increasing the potential for blockage.

The amount of lymphatic fluid that is transported through the affected areas is directly related to the amount of blood flow to those areas. **H**eavy lifting with the affected arm or leg, extreme climatic temperatures, extreme water temperatures when bathing, showering, or washing dishes, hot tubs, saunas, sunburn, and vigorous repetitive movements against resistance, all of which will increase blood and lymphatic flow to the affected area, should be avoided. When a post-operative node dissection patient is fighting off an infection there will typically be an increase in lymphatic load as well as a decrease in transport capacity. Cellulitis and lymphangitis can inflame the lymphatic vessels, making them dysfunctional to transport lymphatic fluid. When patients are traveling by airplane, it is important to wear a fitted sleeve or stocking due to pressure changes which allow fluid to pool in the extremities. Due to the lack of movement during flight, the vessels which normally pump the lymph towards the regional lymph nodes are working at a very low level. Therefore, it is not only important to wear compression garments, but to move around the cabin whenever possible to prevent the pooling that can increase lymphatic load. While each of these precautions, as well as those listed on the following pages, make perfect sense, there are several other factors that can also influence a potential lymphedema outcome. These include, but are not limited to, the number of lymph nodes that were removed from a given location, the extent of surgical disruption and how many nodes were removed, the amount of lymphatic scarring from radiation, age, and the degree of obesity.

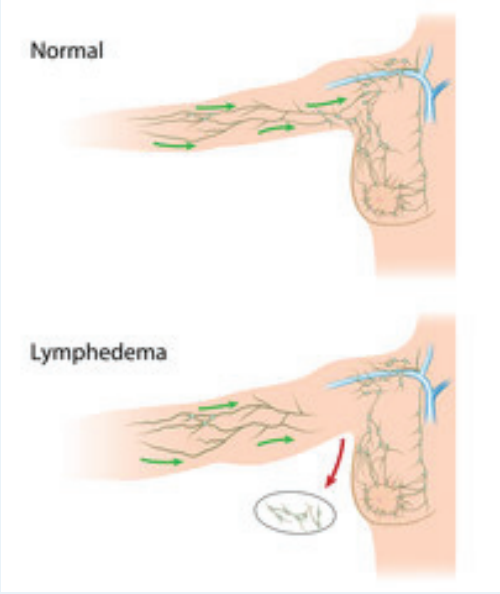
Infections are possible at any stage of lymphedema, but occurrence becomes greater as stages progress. A swollen limb, left untreated, becomes hard (fibrotic) and full of lymph fluid which is high in protein and a perfect medium for bacteria and infections.

REMEMBER: the risk of lymphedema doesn't increase or decrease with time!

All cancer treatment survivors, including those of melanoma, prostate and ovarian cancer, are susceptible to developing lymphedema. Breast cancer survivors can be at a high risk for developing lymphedema and 100% of those treated for neck and head cancer will develop the disease, according to the Lymphatic Education and Research Network [144]. ***It is important to remember that if a patient has undergone a lymph node dissection or radiation for any type of cancer, they are at risk for lymphedema in that part of the body.*** With proper education and care, lymphedema can be avoided, or, if it develops, kept well under control. Older individuals and those with poor nutrition face an increased risk, as do individuals with infections. Removal of the nodes and damage to the area prevent the lymph fluid in the arm from draining properly, allowing it to accumulate in the tissue by restricting pathways and causing back-up. It has been well documented that the development of lymphedema after breast cancer surgery and radiotherapy is related to the extent of the lymph node dissection, the extent of the breast surgery, and whether radiotherapy is given to the axilla [144].

If lymphedema goes untreated, it can result in decreased function, range of motion, numbness, and swelling of the affected area. In addition, this damage may result in pain and tightness in the area as the lymph vessels close-up, tighten, and sometimes snap.

Guarding against infection is extremely important because the affected area will be more susceptible to infection and infection can cause increased swelling. If any signs of infection are noticed, the patients should contact their doctor immediately. These signs include swelling, fever, or skin that is red, tender, warm, persistently itchy or blotchy.



There are four stages of lymphedema:

STAGE 0	STAGE 1	STAGE 2	STAGE 3 -
Also known as the latent or preclinical stage. This is a newly added classification. At this stage the patient is at risk of developing lymphedema, however no swelling or other visible evidence of impaired lymph transport is present.	When the skin is pressed the pressure will leave a pit that takes some time to fill back in. This is referred to as pitting edema. Sometimes the swelling can be reduced by elevating the limb for a few hours. There is little or no fibrosis at this stage, so it is usually reversible.	When the swollen area is pressed, it does not pit, and the swelling is not reduced very much by elevation. If left untreated, the tissue of the limb gradually hardens and becomes fibrotic.	The lymphedema is often referred to as lymphatic elephantiasis. It occurs almost exclusively in the legs after progressive, long-term, and untreated lymphedema. At this stage there may be gross changes to the skin. There may even be some leakage of fluid through the tissue in the affected area, especially if there is a cut or sore. While lymphedema will respond to treatment, at this stage it is rarely reversible. Lymphedema is a very serious condition and should not be taken lightly. It frequently results in complications, such as lymphangitis (a bacterial infection of the lymphatic system), skin changes, fibrosis, and infection. There are even a few life-threatening complications, although rare, such as the development of a rare type of cancer, lymphangiosarcoma, in the affected area. This can occur in clients with long-term, untreated, or improperly treated lymphedema. Unfortunately, this condition requires immediate amputation. Lymphedema may worsen with time if it is not attended to. It can become disabling by stiffening the joints or making the limbs heavy and may cause significant cosmetic deformities.

USING COMPRESSION BANDAGES

Compression bandages apply external pressure to a swollen limb. When swelling has persisted in an area, the tissue loses some of its elasticity and does not return to its original position and shape, even when the fluid decreases. The bandages support the skin and underlying blood vessels. Bandaging usually starts with gauze tape at the fingers and then continues with a series of different sized short-stretch bandages around the hand, progressing up the arm to within a short distance of the shoulder. The number of bandages used depends on the size of the arm and how effectively the compression is achieved. Many therapists recommend wearing the bandages while sleeping, as well as anytime that you are engaging in physical activity or exercising.

In addition to bandaging, most clients should be fitted with a compression sleeve that is worn during the day time. The garments are not designed to reduce swelling, however, but to maintain the size of the limb and prevent swelling from increasing. Some clients will use a sleeve when flying on an airplane in order to reduce their chances of getting lymphedema due to the changes in cabin pressure.

EXERCISE AND LYMPHEDEMA

Everyone knows the benefits of exercise for seemingly healthy individuals, but they carry even more of a punch for those suffering from lymphedema. Those who exercise have a lower percentage of body fat. Keeping body fat in check can help to prevent lymphedema. Fat can be a special problem with an impaired lymphatic system. Fat is deposited in the interstitial tissue and can make it more difficult for the fluid to pass through and into the lymph vessels. The lymphatic system is stimulated by the pumping action of the blood vessels, as well as the pumping action of muscles, so anything one does to improve their circulatory system will be helpful for the lymphatic system. A good exercise goal, for aerobic activity, is thirty minutes three or four times a week. Choose an exercise that will allow the patient to mildly increase their heart rate without "over-doing" it. **I**t is important that they wear their support garment or bandage while exercising. Bandages increase pressure against the skin during exercise.

The pressure, coupled with the contraction of their muscles, encourages the lymph to move. Exercise, in and of itself, will help to pump the muscles, improve circulation, and move lymph from congested areas into an area where it can drain more efficiently. **I**t is important to start out very slowly with few repetitions and wait until the next day to see how the affected limb has responded. You can gradually increase their repetitions, based on what the limb will tolerate. **H**ave clients take their time and use good form and posture.

BREATHING:

One of the most important and often over looked components of exercise is breathing. Not only does breathing allow precious oxygen to be circulated through the bloodstream, but it is also effective for moving fluid through a gentle pumping action of the abdominal muscles. The fluid is pumped through the central lymphatic vessel in the chest cavity, stimulating the flow of lymph. When you breathe in, using your abdominal muscles, the pressure in the chest cavity changes, because the belly breath moves your diaphragm. When you exhale, the pressure changes once again. This back-and-forth alternation in the pressure acts like a pump on the large lymphatic trunk that runs up through the chest cavity and drains into the venous system of the neck.

Here's how - sit in an upright position. Take a deep breath through your nose and exhale through your mouth, flattening your belly and squeezing out every bit of air. Emptying the lungs completely and removing all the stale air from the bottom of the lungs automatically stimulates a diaphragmatic breath. Breathe in through your nose and notice how your belly expands. Repeat the sequence again. Let the air out through your mouth, making sure your belly flattens. Try another one or two breaths this way. **I**f you get light-headed, try to slow down your inhalation, and pause before breathing in again. **I**t is not necessary to breathe with a giant breath – just one that goes to the bottom of your lungs, while your chest remains still. **I**magine a balloon in your stomach that inflates when you inhale and deflates when you exhale.

UPPER EXTREMITY LYMPHEDEMA

At risk for upper extremity lymphedema, is anyone who has had lymph node dissection and/or radiation therapy in the head or neck area, chest area, or breast(s). There is limited evidence to suggest that Taxane-based chemotherapy may cause fluid accumulation by increasing extracellular fluid [111]. Just as with lower extremity lymphedema, it is caused by an accumulation of lymph fluid in the tissue, can occur at any time after surgery, and can be prevented and/or controlled with proper care.

PRECAUTIONS TO AVOID OR MANAGE UPPER EXTREMITY LYMPHEDEMA

- Avoid insect bites, burns, skin irritants, hangnails, and torn cuticles (wearing gloves while doing housework or gardening is a great idea)
- Avoid tight fitting jewelry on the affected arm or hand
- Wear loose fitting clothing on arms, chest, and shoulders
- Don't overheat – avoid saunas, whirlpools, steam rooms, hot baths, and sun bathing
- Don't receive shots, have blood drawn, or have blood pressure taken on affected arm
- If client is overweight and has experienced swelling, losing weight can help reduce it by reducing the amount of fatty tissue which retains fluid and blocks lymphatic pathways
- Remember that tennis, racquetball, golf, and bowling are all considered risky sports (because of repetitive shoulder movements)
- Keep the at-risk arm(s) spotlessly clean and use lotion after bathing
- Avoid repetitive day-to-day movements such as scrubbing, pushing, or pulling, with the at-risk arm
- Avoid heavy lifting with the affected or at-risk arm. Never carry heavy handbags or bags with over-the-shoulder straps on the affected arm
- When traveling by air, clients with lymphedema, or those who are at risk, should consider wearing a well-fitted compression sleeve
- Use an electric razor when shaving neck (cervical lymph nodes) or armpits (axillary node dissection)
- Make skin and nail care high priorities. Inspect the skin on your arm daily, watching for changes or breaks in your skin that could lead to infection.

LYMPH DRAINAGE EXERCISES FOR UPPER EXTREMITY LYMPHEDEMA PREVENTION AND MANAGEMENT

Prior to beginning these exercises, clients/patients should start with a five minute aerobic warmup. As they begin each of the following exercises Instruct them to take several deep abdominal breaths (as were described on page 79).

1. **Pelvic tilt –** have your client/patient lie on their back with their knees bent and feet flat on the floor. Have them tilt their hips so that they are able to press the small of their back against the floor. Have them pause for several seconds then release the contraction. Repeat 5-10 times.

2. **Modified sit-up –** have your client/patient lie on their back with their knees bent and feet flat on the floor. Instruct them to maintain a neutral pelvis. Have them keep their neck in neutral and their chin pointing to the ceiling. As they exhale, have them lift their chest and shoulders, pausing when they feel their abdominal muscles tighten up. Have them slowly lower themselves back to starting position (trying not to rest between repetitions). Repeat as many times as they can comfortably. *Skip this exercise if your client/patient has had an abdominal TRAM.

**If your client/patient has neck issues, they can place a 55cm exercise ball on their stomach and against their bent legs. Keeping their arms straight and reaching toward ceiling, and their head relaxed on the floor, they should engage their abdominal muscles and press their arms against the ball. They can repeat this as many times as they can comfortably. This can also be done sitting upright in a chair (only the ball will be on their lap and their arms will be parallel to the floor) for someone who is unable to get to the ground.

3. **Neck stretches –** refer to the neck stretches in the stretching section in Module Three. These stretches can be done by the client/patient, or with assistance from the CES.

4. **Shoulder shrugs –** have your client/patient shrug both shoulders, lifting them towards their ears as they inhale. Have them exhale and depress their shoulders as low as they can (attempting to reach the floor with their fingertips) then return to a relaxed position. Repeat 5-10 times.

5. **Shoulder rolls –** have your client/patient lift their shoulders up to the ears then rotate the shoulders back and down, making a smooth, continuous motion. Repeat 5-10 times in each direction.

6. **Isometric shoulder blade squeeze –** have your client/patient bend their elbows at 45-90 degrees out at their sides (parallel to the floor). Have them exhale and pull them towards the center of their back, squeezing the shoulder blades together. Pause. Have them inhale and return to starting position. Repeat 5-10 times.

7. **Isometric chest-press –** have your client/patient place the palms of their hands together, with their elbows bent and arms at or below shoulder level. Have them exhale and push their hands firmly together. Pause. Have them inhale and relax. Repeat 5-10 times.

8. **Shoulder circles –** have your client/patient hold their arms at or below shoulder height with their palms facing down. Have them make small circles with their arms (keeping arms elevated). Repeat 5-10 times in each direction.

9. **Wrist circles –** have your client/patient hold their arms overhead and rotate their fist in small circles, isolating the movement to the wrist only. Rotate 5-10 times in each direction.

10. **Wrist flexion and extension –** have your client/patient hold their arms overhead and flex and extend their wrists, isolating the movement to the wrist only. Repeat 5-10 times.

11. **Fist clench –** have your client/patient hold their arms overhead and open their hands and stretch their fingers, spreading them apart. Then have them slowly clench each hand to make a fist. Pause. Repeat 5-10 times.

CIRCUMFERENCE ASSESSMENT PROTOCOL

Purpose: To measure the circumference of the effective area during initial assessment to determine baseline measurement in order to monitor any changes in size that could indicate the onset of lymphedema.

Equipment: Tension Regulated Tape Measure.

P R O C E D U R E S :

Deciding which measurements to take- If your client has undergone a lymph node dissection or radiation to a particular area, it will be necessary to take measurements of all possible sites for lymphedema. It is important to understand the pattern of lymphatic flow **(See page 76).** Gravity will naturally pull the lymphatic fluid downward except for the neck. If someone has lymph nodes removed or irradiated in their neck, you will want to take measurements of the neck and/or look for pitting in the jawline and temple area. If there is significant swelling following a workout, not only do they need to see their doctor to see If they have lymphedema, It may also suggest that the intensity and duration of exercise was too much for their current level of fitness. When your client resumes exercising, they should reduce both the intensity and duration to control swelling (This applies to clients who already have lymphedema as well) Make sure they return to you with a medical clearance form stating that it is okay for them to resume exercise with or without limitations.

CHEST CIRCUMFERENCE

1. **T**he chest circumference test is done with the participant standing erect, naturally, with the arms hanging downward but slightly away from the trunk.
2. With a tension regulated tape measure, the examiner will take a single measurement around the nipple-line of the chest.

A. ARM CIRCUMFERENCE

FIGURE 1A

FIGURE 1B

FIGURE 1C

1. The arm circumference test is done with the participant standing erect, naturally, with the arms hanging downward but slightly away from the trunk.

2. With a tension regulated tape measure, the examiner will take the following measurements:

   - Around the distal epiphysis of the ulna and radius **(Figure 1A)**
   - **(Figure 1B)** ½ way between the elbow crease and the epiphysis of the ulna and radius **(Figure 1C)**
   - Around the medial and lateral epicondyles of the elbow **(Figure 1D)**
   - **(Figure 1E)** ½ way between the elbow epicondyles and the head of the humerus **(Figure 1F)**

3. Don't pull the tape tightly; just circle the arm with it.

4. If client/patient notices fullness, redness, warmth, or pins and needles sensation in the affected area, they should perform a "pitting" test (press thumb into affected area and see if it holds the indentation). Normal tissue should blanche and refill immediately. If there is pitting, they should take measurements as well. If there is a significant increase in their baseline measurements, along with visible pitting, it is considered swollen and they should stop exercising and consult a physician.

FIGURE 1D

FIGURE 1E

FIGURE 1F

CHAPTER SIX

MUSCLE BALANCE AND EVALUATION

Program Design

Objective: to learn how to conduct a postural assessment and understand the balance of antagonists and antagonists in order to sequentially determine individualized programming based on:

- Range of Motion Limitations
- Correcting Postural Deviations
- Acute & Chronic Treatment Side-Effects
- Lymphedema Identification, Prevention, & Management

Goal: to correct muscle imbalances and ROM limitations by determining the proper combinations of strength training exercises and stretching while taking precautions to avoid lymphedema, pain, and other undesirable mental and physical side-effects.

POSTURE

Good posture involves training the body to stand, walk, sit and lie in positions where the least strain is placed on supporting muscles and ligaments during movement or weight-bearing activities. It is the result of alignment of all of the joints in the body at any given moment in time (Kendall, McCreary, and Provance 1993). From a ***biomechanical perspective,*** imbalance between agonists and antagonists in standing posture changes alignment and negatively affects the position of the parts of the body above and below the "faulty" area. From a ***functional perspective,*** the neurological, muscular, and articular systems form an inseparable unit. The central nervous system (CNS) regulates the muscles ability to produce and control motion and stabilize and protect the joints. When there is a dysfunction resulting from injury, pathology, or chronic overuse, you will most likely observe changes in muscle function.

Poor posture leads to adaptive patterns of movement and balance; thus causing undue stress on the musculoskeletal system, resulting in wear and tear on the joints and increased likelihood of injury. Once the body begins to compensate for poor habits or injury, the body begins to know this as its new "norm." This leads to patterns of muscle tightness and weakness.

For example, for every inch the head moves forward from neutral posture, the weight carried by the lower neck increases by the additional weight of the entire head. (Liebenson C, ed. Rehabilitation of the Spine. Baltimore: Williams and Wilkins, 1996:177.)

According to the late Dr. Vladamir Janda, a Czech neurologist, there are two basic causes of muscle imbalance; structural and functional. Our standards of care in orthopedic medicine are based primarily on a structural approach. They rely on the visualization of structure through modalities such as X-ray, MRI, and/or surgery. When you hear the term ***"structural lesion,"*** it is referring to damage to physical structures such as bones or ligaments that can be diagnosed through these sophisticated tests and procedures. The structural lesions can be repaired with the proper combination of immobilization, surgery (when necessary), and rehabilitation. What happens, however, when these diagnostic tests are inconclusive? We find ourselves as both clients and practitioners at a loss. It is frustrating on many different levels as we try to "fix" something that we are being told does not exist. This is where the term "functional lesion" comes in to play. A ***"functional lesion"*** is an impairment in the ability of the structure to perform its normal tasks; movement, strength, flexibility, etc... Our dilemma is that this type of lesion is not as easy to treat because the analysis of the problem is not as cut and dry as it is with a structural lesion. As practitioners it is our job to get to the root of the problem and determine the source of origination of the functional lesion. We must analyze the particular dysfunction by looking at the interactions of all the structures and systems that may contribute to the problem. MRIs, X-rays and surgery are designed to "diagnose" and "cure" the problem, but they overlook an important part of the problem; the source. If we do not identify the source of the problem, it stands to reason, that it cannot be cured or rehabilitated.

When we use the term "muscle balance," we are referring to the equality of muscle strength between the agonist and antagonist muscles.

Agonists are the muscles that act as prime movers whereas antagonists are muscles that act in direct opposition to prime movers. Synergists are muscles that assist the prime movers during functional movement patterns. Stabilizers are muscles that support or stabilize the body while the prime movers and the synergists perform the movement patterns.

Without this balance it would be impossible to properly execute movement and function. Muscle balance can also be viewed as the strength and balance between contralateral (right vs. left) muscle groups. If your client is right-side dominant, the strength in their right quadricep may be significantly greater than that of the left quadricep. This can create a chain reaction of problems from the hip to the ankle as the body tries to compensate for and adapt to the imbalance. Sometimes it is an injury itself that can cause a muscle imbalance while other times the muscle imbalance leads to the injury. There are two ways to look at muscle imbalances. The first is ***biomechanical,*** caused by repetitive movements and postural deviations that put undue stress on the joints. As our bodies try and adapt to repetitive motions and/or postural imbalances, there will most likely be adaptations in muscles length, strength, and flexibility. As a muscle becomes dominant over its fellow synergists, joint motion will change and can lead to abnormal stress on a particular joint.

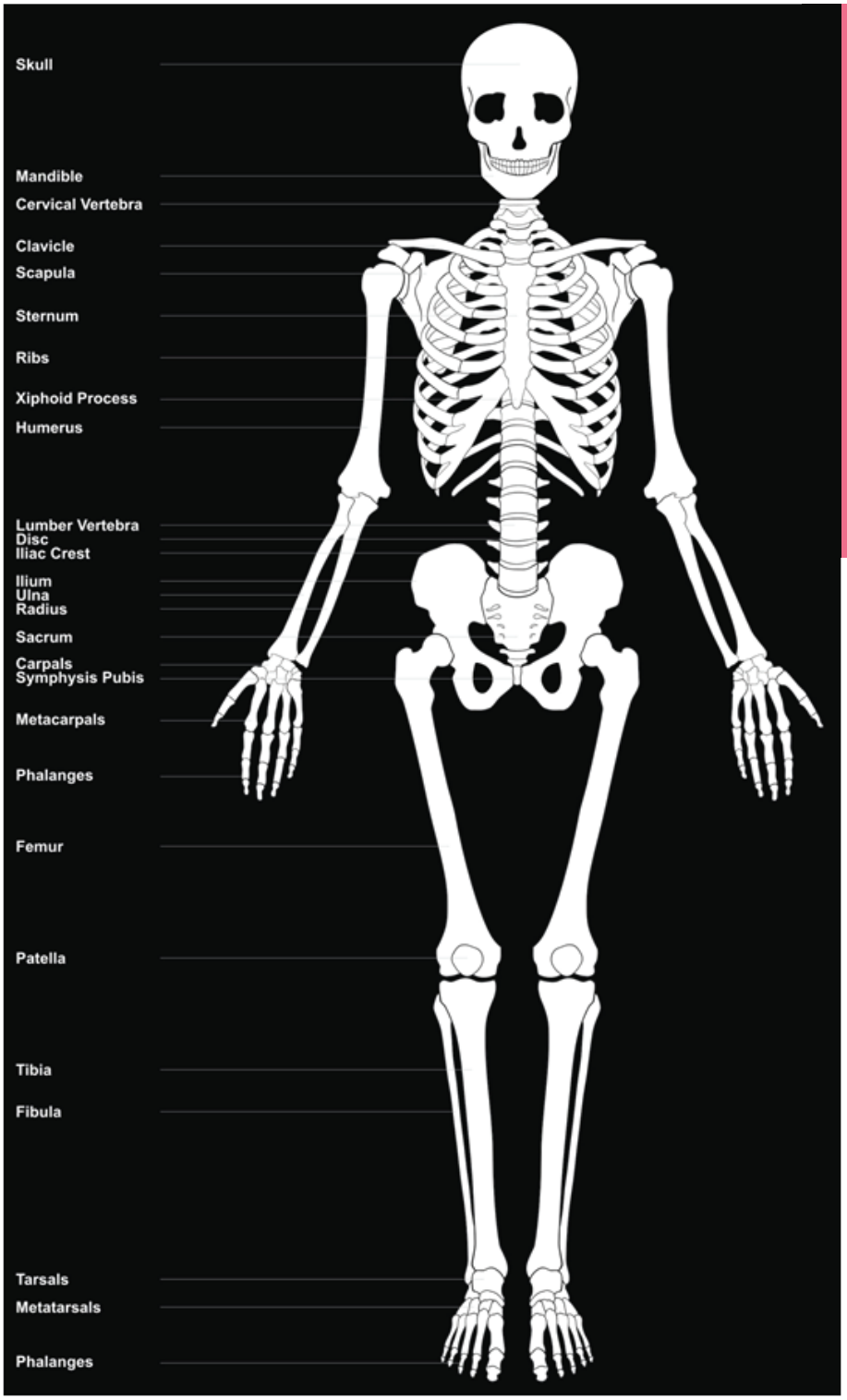
The second is ***neurological.*** They are not, however, exclusive of one another as both may contribute to the imbalance. Janda believed that many chronic musculoskeletal conditions are the result of faulty motor learning that prevents the motor system from properly reacting or adapting to different changes within the body. The result of this is seen in poor reflexive or mechanical performance. All systems in the human body function automatically except for the motor system. Therefore, Janda believed that chronic musculoskeletal pain and muscle imbalance are a functional pathology (impaired function of the structures rather than damage to the structures) of the CNS. He stated that muscle imbalances often begin after an injury or pathology leads to pain and inflammation. Muscle imbalances may also arise from alterations in proprioceptive input resulting from abnormal joint position or motion. ***Proprioception*** is one form of afferent information that uses mechanoreceptors to provide information about static and dynamic positions, movements, and sensations that relate to muscle force and movement. This afferent information is delivered within the CNS and is used to manipulate and monitor movement. These two conditions can ultimately lead to muscles that become hypertonic (tight), or inhibited (weak). As the body tries to create a new homeostasis, the imbalance becomes "normal" to the CNS and results in a new pattern of movement.

The necessary ingredient for muscle balance is the functional integration of the sensory and motor systems. Sensory information is elicited in motor response through the central and peripheral nervous systems. It receives information from receptors to determine things such as the body's position in space, limb orientation, information about the environment, temperature, texture, and other external factors. Sensory information is critical in order to protect the body from harm. ***Afferent information*** refers to sensory input to the CNS that plays several roles in creating motor responses (Holm, Inhahl, and Solomonow 2002). These include triggering a reflex response, determining the extent of programmed, voluntary responses, and integrating feedback for automatic motor output to maintain balance for standing and walking.

Postural stability, or balance, is the ability of the body to maintain its center of gravity within its base of support and limits of stability. It is the result of processing and output of information from the PNS and CNS. Balance of agonists and antagonists is necessary in order for ligaments to provide adequate joint stability and equalize pressure distribution. There are two types of stability that we will refer to; ***dynamic and static.*** Dynamic stability is the result of muscular contraction. It is also referred to as ***functional joint stabilization.*** Static stability comes from passive structures such as bony congruities, ligaments, and joint capsules.

"He who treats the site of the pain is often lost," Karl Lewis.

Tensegrity is the inherent stability of structures based on synergy between tension and compression components. In other words, the body rearranges itself in response to changes in load. The principle of a "***kinetic chain***" suggests that each part of the body is interconnected. For example, forces in the foot and ankle can affect body parts such as the knees, the hips, and the lower back. Therefore, if something is out of alignment, or functioning improperly, the body will rearrange itself to compensate for the inadequacy.



> ***Postural chains*** are the position of one joint in relation to the other when the body is in an upright position. We refer most often to the postural chain that occurs throughout the spine. The postural position of the cervical, thoracic, and lumbar spine is looked at in relation to musculoskeletal pain. We emphasize proper positioning in these areas during exercise to promote safe movement and reduce the risk of injury. Because these regions are connected through the vertebral column, changes in one region can cause a chain reaction leading to changes in another region.

Here are some examples:

- Poor sitting posture encourages a posterior pelvic tilt. This reduces the normal lordotic curve of the spine. It also reverses the normal kyphotic curve of the spine and encourages the forward position of the head that is often associated with poor posture.

- The rib cage is an important structure to consider because of its direct influence on the position of the thoracolumbar spine. Those who are weak in the diaphragm and deep spinal stabilizers will often elevate the lower rib cage during inspiration as a compensation for breathing. The repetitive and continuous elevation of the ribs leads to posterior rotation of the ribs on the vertebrae at the costovertebral joint (articulations that connect the heads of the ribs with the bodies of the thoracic vertebrae) and to relative anterior rotation of the vertebrae on the ribs. Ideal posture is sacrificed in an attempt to maintain respiratory integrity.

- An anterior pelvic tilt is associated with tight hip flexors, whereas a posterior pelvic tilt is associated with tight hamstrings.

- Foot pronation causes tibial internal rotation, which causes knee valgus (knock-knees), and hip internal rotation.

Muscular chains are groups of muscles that work together to influence each other through movement patterns.

Myofascial chains rely on the integrity of the muscle fascia as a vital link to multiple muscles acting together for movement; as well as connecting the extremities through the trunk.

Neuromuscular chains provide our bodies with critical reflexes for function and protection. These reflexes serve as the basis for all human movement patterns.

Sensorimotor chains are linked neurologically through afferent (input) and efferent (output) systems for function. They are both reflexive and adaptive and provide local and global dynamic stabilization of the joints.

Now that we have a basic understanding of the principles of "chains" and how they work together both in compensation and adaptation, we are going to get even more specific. The CNS is responsible for regulating two groups of muscles within the body; ***Tonic and Phasic.***

Neurodevelopmental movement patterns can be broken down into these two groups. These terms are not used in the physiological description of muscle fiber (slow twitch vs. fast twitch). Tonic muscles are dominant and are involved in repetitive or rhythmic activities as well as the upper and lower extremities' withdrawal reflexes. Their main responsibility is flexion. Phasic muscles tend to be predominant in extension and typically serve as postural stabilizers, working against gravity. These systems do not function independently. They work synergistically in posture, gait, and coordination of movement. Therefore, when we refer to muscle balance, we are really referring to the interaction between the tonic and phasic systems.

In essence these systems are the "default" motor program of human movement dating back to the beginning of time. The proper balance of the two systems would be seen in someone with "normal" gait and posture. When you watch someone walk you will notice the contralateral movement pattern between the upper and lower body. The right arm and leg will be in flexion at the same time and the same will apply to the left side. With leg extension you will see arm extension on the opposite side. This can be noted in creeping, crawling, swimming, and walking. For you to be skilled at assessing one's posture you must understand which muscles are more prone to tightness vs. which muscles are more prone to weakness.

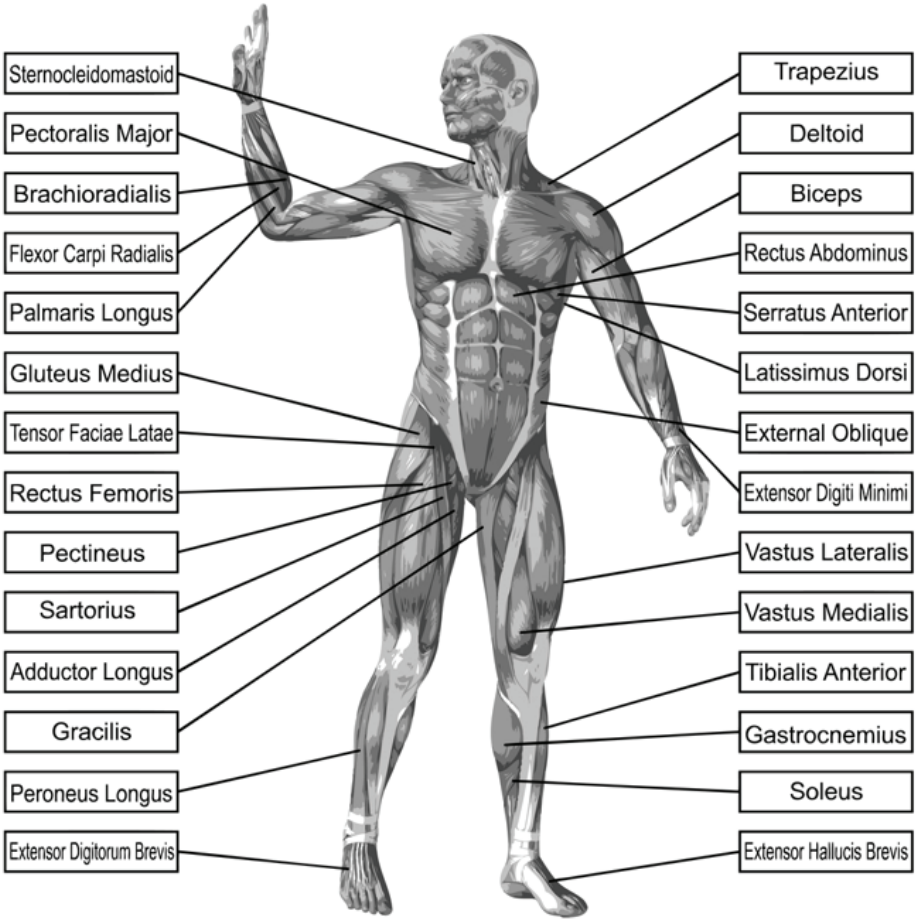
TABLE 1.0 - TONIC AND PHASIC MUSCLES OF THE UPPER BODY

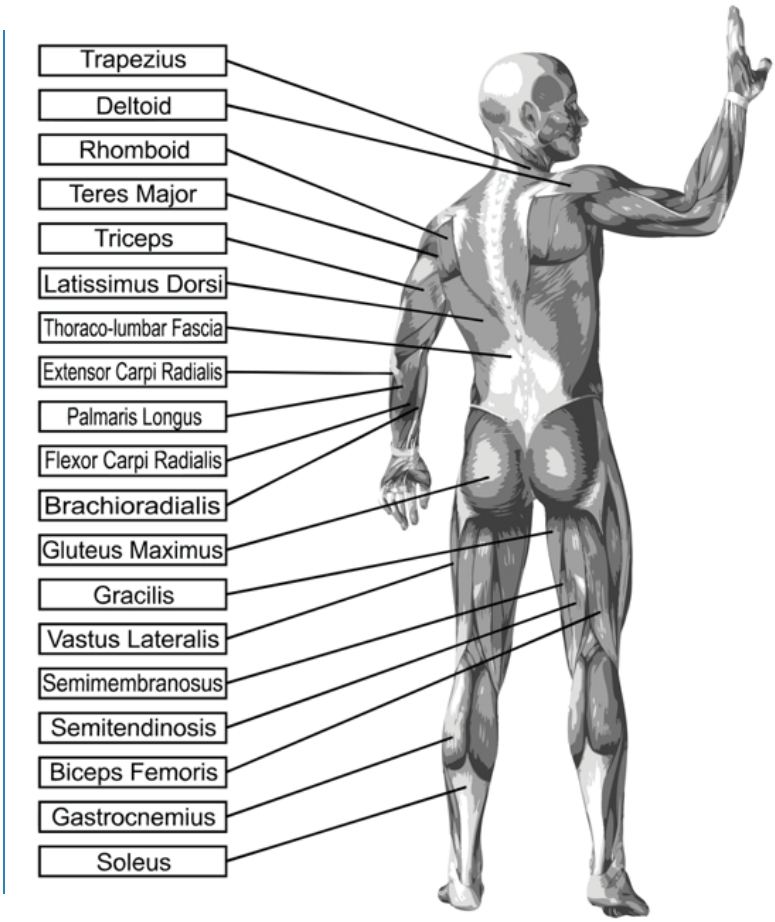
TONIC (TIGHT) MUSCLES OF UPPER BODY	PHASIC (WEAK) MUSCLES OF UPPER BODY
Pectoralis major/minor	Middle and lower trapezius
Levator scapulae	Rhomboids
Scalenes	Serratus anterior
Upper trapezius	Deep cervical flexors
Sternocleidomastoid	Scalenes
Latissimus dorsi	Extensors and supinators
Flexors and pronators	

TABLE 1.1 - TONIC AND PHASIC MUSCLES OF THE LOWER BODY

TONIC (TIGHT) MUSCLES OF LOWER BODY	PHASIC (WEAK) MUSCLES OF LOWER BODY
Quadratus lumborum	Rectus abdominis
Thoracolumbar paraspinals	Gluteus maximus/medius/minimus
Piriformis	Vastus medialis/lateralis
Iliopsoas	Tibialis anterior
Rectus femoris	Peroneals
IT band	
Hamstrings	
Hip adductors	
Soleus	
Tibialis posterior	

Keep in mind that some muscles may exhibit both characteristics, but will typically be one or the other.


Sternocleidomastoid
Pectoralis Major
Brachioradialis
Flexor Carpi Radialis
Palmaris Longus
Gluteus Medius
Tensor Faciae Latae
Rectus Femoris
Pectineus
Sartorius
Adductor Longus
Gracilis
Peroneus Longus
Extensor Digitorum Brevis
Trapezius
Deltoid
Biceps
Rectus Abdominus
Serratus Anterior
Latissimus Dorsi
External Oblique
Extensor Digiti Minimi
Vastus Lateralis
Vastus Medialis
Tibialis Anterior
Gastrocnemius
Soleus
Extensor Hallucis Brevis


Trapezius
Deltoid
Rhomboid
Teres Major
Triceps
Latissimus Dorsi
Thoraco-lumbar Fascia
Extensor Carpi Radialis
Palmaris Longus
Flexor Carpi Radialis
Brachioradialis
Gluteus Maximus
Gracilis
Vastus Lateralis
Semimembranosus
Semitendinosis
Biceps Femoris
Gastrocnemius
Soleus

PAIN AND MUSCLE IMBALANCE

If we injure ourselves, it is safe to assume that the particular injury will heal itself in a reasonable amount of time.

When someone comes to you with chronic musculoskeletal pain it may suggest that the problem lies within the muscle, or group of muscles. More often than not, it will not stem from the bones, joints, and ligaments. Most muscle pain is the result of a muscle spasm and the resulting ischemia (inadequate circulation to a local area due to blockage of the blood vessels in the area) from the prolonged muscle contraction.

This will ultimately lead to fatigue and result in a decreased ability to meet normal postural and movement demands. In the acute phase of pain the muscles may respond by altering movement patterns to compensate for the injured area. As time passes, the CNS will adapt this altered movement pattern. Our bodies have a protective adaptation to pain in which the flexor response is activated to protect the injured area. Not only will this affect movement patterns, it will also result in decreased range of motion. These altered movement patterns will ultimately lead to altered joint position which will cause more stress on the joints. This can also be caused by ***altered reciprocal inhibition.*** This is the process by which a tight muscle causes decreased neural drive and, therefore, optimal recruitment of its functional antagonist is not achieved. Altered reciprocal inhibition may lead to synergistic dominance. This is the process in which a ***synergist compensates*** for a prime mover to maintain ***force production*** (the force generated by a muscle action).

It is paradoxical that the muscle imbalance may be the source of the pain or it may be the result of the pain.

Vladamir Janda observed three distinct stereotypical patterns of muscle tightness/weakness that cross between the dorsal and ventral sides of the body. The first, and perhaps most common is ***upper-crossed syndrome.*** Tightness in the levator scapulae and upper trapezius on the dorsal side crosses with the tightness of the pectoralis major/minor. Weakness of the deep cervical flexors on the ventral side crosses with weakness of the middle and lower trapezius. This pattern of muscle imbalance creates joint dysfunction that results in forward head, cervical lordosis, elevated and protracted (rounded) shoulders, winged scapulae, and thoracic kyphosis. This combination wreaks havoc on the glenohumeral joint by decreasing joint stability, which then leads to increased activation by the levator scapulae and upper trapezius, in an effort to maintain the integrity of the joint.

Individuals who present with upper-crossed syndrome typically exhibit rotator cuff impingement, shoulder instability, biceps tendinitis, thoracic outlet syndrome, and headaches.

Lower-crossed syndrome manifests when the tightness in the thoracolumbar extensors on the dorsal side crosses with the tightness of the iliopsoas and rectus femoris. Weakness of the deep abdominal muscles ventrally crosses with weakness of the gluteus maximus/medius. Look for increased lumbar lordosis, lateral lumbar shift and leg rotation, and knee hyperextension. There are two variations of LCS; anterior tilt and posterior tilt. The client with an anterior pelvic tilt will usually present with slight hip and knee flexion and hyperlordosis of the lumbar spine and hyperkyphosis of the upper lumbar and lower thoracolumbar areas. Those with a posterior pelvic tilt present with locked out knees, hypolordosis (flat back), thoracic hyperkyphosis and head protraction. More than likely they will also have tight hamstrings and dynamic movement patterns may be affected. Individuals who present with lower-crossed syndrome typically exhibit anterior knee and low back pain, posterior tibialis (shin-splints), and plantar fasciitis.

Layer syndrome is the combination of LCS and UCS where clients display impairment with motor skills and have a poorer prognosis because of the longer duration of their impairment. You are more likely to see this in the elderly.

Chronic muscle imbalance can lead to altered patterns of movement. There are several factors that can affect muscle balance:

- **Repetitive movement -** can result in overuse or injury and can lead to a change in elasticity of the muscle. It may be as simple as bad posture and lack of regular daily activity. Muscle that is repeatedly placed in a shortened position (psoas complex during sitting, or pectorals following a mastectomy/radiation), will eventually adapt to that new position and it will become its new “norm.”

- **Acute injury -** an individual may alter their movement patterns to avoid pain, or to perform an activity out of desire or necessity. Because of the newly established “norm,” an individual may need to re-train their body back to their more normal motor pattern. Injury can also result in tissue that becomes ***hypomobile*** (restricted) from splinting or self-immobilization due to pain.

- **Surgery -** scar tissue can alter tissue alignment and pull on the fascia. This will alter muscle and joint function. It is critical to assess ROM and posture and develop a corrective strategy to return to a normal motor pattern and correct imbalances.

POSTURAL ANALYSIS TEST PROTOCOL

Purpose: to determine muscle imbalances; which may cause unnecessary stress on the bones, joints, ligaments, and muscles.

Equipment: none

Procedures: a thorough postural analysis is essential to get a clear understanding of symmetry, contour, and tone of the muscles as they are observed in static posture. The postural analysis is done with the participant wearing minimal clothing, standing erect (naturally) with the arms hanging downward at their sides, and bare feet. Have client march in place with their eyes closed for a few seconds, making sure that they are standing **naturally**. Have them stop marching, hold their position, and open their eyes. Ask them to stand as still as they can so that you can conduct the assessment. If you are working with a client who has difficulty with balance, it is okay to have them stand near a wall or countertop, or have a chair near by them to give them a sense of security.

Begin by looking posteriorly at spinal curves; excessiveness, scoliosis, leg-length discrepancy, or other orthopedic deviations. From there you should evaluate the pelvis; as this is where most dysfunctions of the lumbar spine, SI joint, and lower limbs will originate. Not only can the pelvic tilt affect lumbar lordosis, it can also influence the orientation of the head and other parts of the body.

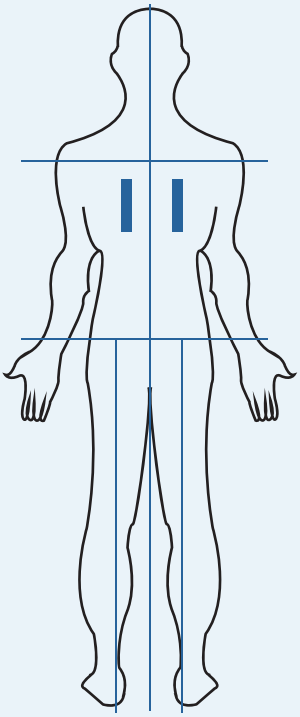
The position of the pelvis should be evaluated by locating the iliac crests and the anterior and posterior iliac spines. Locating the posterior/anterior superior iliac spine:

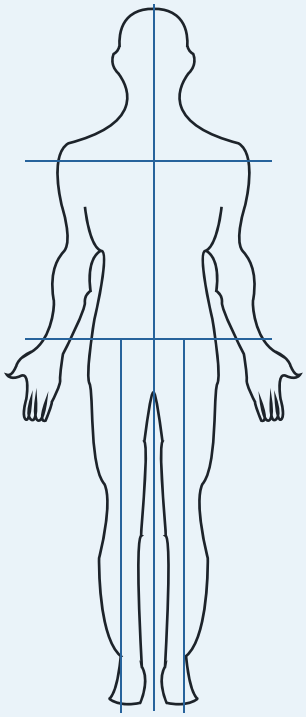
The ilium is the most superior part of the innominate bone and articulates the pelvis with the spinal column through the sacrum. At the most anterior and posterior aspects of the ilium are bony prominences known as the anterior superior iliac spine (ASIS) and posterior superior iliac spine (PSIS). The ridge of bone that runs between the ASIS and PSIS, and is a major source of muscle attachments, is known as the crest of the ilium or iliac crest. Place your hands on your clients' hips and feel for the iliac crests. While you are doing so, follow the crest to its anterior and posterior ends and those will be the ASIS and PSIS.

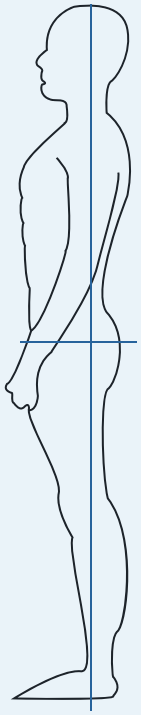
After identifying the aforementioned structures, there are several things you will want to look for:

- Lateral tilt
- Rotation
- Anterior tilt
- Posterior tilt

POSTURAL ALIGNMENT CHECKLIST







LOOKING AT THE SUBJECT FROM THE BACK:

- Head should be erect and not tilted to either side
- Shoulders should be level and one should not be higher than the other
- Shoulder blades should not be “winged” and they should be at the same height
- Curvatures of the spine are minimal (no scoliosis)
- Hips should be at the same level; one should not be higher than the other
- Legs are vertical
- Arches of the feet should not be excessively flat or raised, but should appear normal
- Heels should be equal distance apart
- Body weight should appear to be evenly distributed on both feet

LOOKING AT THE SUBJECT FROM THE FRONT:

- Head should be erect and should not be tilted to either side
- Shoulders should be level and one should not be higher than the other
- Arms and hands should face toward the body. If there is considerable round shoulderedness, it will cause the hands to rotate so that the palms face backward
- Hips should be at the same level; one should not be higher than the other
- Legs are vertical and kneecaps should face forward and be centered
- Toes should be in a straight line
- Feet should be turned out at about ten degrees
- Arches of the feet should not be excessively flat, or raised, but should appear normal
- Heels should be equal distance apart
- Body weight should appear to be evenly distributed over the feet

LOOKING AT THE SUBJECT FROM THE SIDE:

- Head should be erect and should not be pulled back or extended forward
- Shoulders should be level and should not be rounded
- Curvatures of the spine should be minimal
- Arms and hands should face towards the body
- Chest should be lifted and should not appear depressed or protruding
- Abdominals should be flat
- Knees should not be over flexed or hyperextended, but should appear straight
- Toes should be in a straight line

CONDUCTING A VIRTUAL POSTURAL ASSESSMENT

Conducting a virtual assessment certainly poses its challenges, but is still a valuable tool for corrective exercise programming. There are a number of variables that can add to, or subract from, the accuracy of your assessment:

- Lighting
- Distracting background
- Camera or computer quality
- Ability of client to follow instructions
- Ability to move camera or computer to catch different angles/perspectives

To make your job easier and more effective, you might ask your client to have someone there with them that can help palpate, move the camera/computer, adjust lighting, etc.

In order to get the client's entire body in the screen you will probably lose clarity of the picture. This can make it very difficult to identify certain muscle imbalances. For this reason, you will need to break the body into top and bottom as well as front, back, left side, and right side.

You will start the process in the same exact fashion as you would in-person (as described on the previous page). I suggest that you have your client's camera/computer focused on their lower body to begin with. After you have gathered all of the essential findings, you can ask them to adjust the view to the top half of their body. If they are adjusting it themselves, you will need to ask them to march in place again each time.

When assessing the hips, it will be incredibly helpful to have an assistant with the client to help palpate the iliac crests, ASIS's, and PSIS's (this can be very difficult to see virtually). If they do not have anyone that can assist, you can describe to your clients how to "find" the top of their hips (iliac crests), the bony protrusions in the front (ASIS's) and the bony protrusions in the back (PSIS's). It will probably take a few tries to get it right. Have them use their index finger to point to these areas while trying to keep the rest of their hand from blocking your view.

Although most people will not want to go shirtless (men) or wear just a sportsbra (women), this may be your only hope of being able to see any alterations in scapular movement or winged scapula. If they have an assistant with them, you can ask them to gently run their hands across their shoulder blades to see if they can "grab" them at all. If they have significant winged scapula, this will be easy to identify.

If you are trying desperately to find an imbalance (anywhere on their body), but just can't be certain, it is probably not significant enough to worry about!

Alterations in scapular positioning at rest and in movement, called scapular dyskinesis, are associated with various diseases of the shoulder, such as impingement syndrome, rotator cuff tear, instabilities and adhesive capsulitis[229].

There is evidence suggesting that scapular positioning is abnormal in patients with shoulder impingement syndrome[222], symptoms of impingement[223, 224], atraumatic shoulder instability[225], multidirectional shoulder joint instability[226], and shoulder pain after neck dissection in cancer patients[227, 228]. As no longitudinal study has yet been reported, it is not known if abnormal scapular positioning is a cause or consequence of shoulder pain or a secondary phenomenon caused by shoulder pain.

It can also be quite difficult to determine if the client has pronated or supinated feet. Asking the assistant to bring the camera/computer closer to the subject, trying different angles, can be very helpful.

Remember that this is not going to be perfect. You are going to do the best that you can do! Even a mediocre postural assessment is going to be better than none.

TABLE 1.2
MUSCLE IMBALANCES AND THEIR POTENTIAL CAUSES

POSTURAL DEVIATION	TIGHT MUSCULATURE	WEAK MUSCULATURE
Forward Head	SCM, Levator Scapulae, Scalenes, Suboccipitals, Upper Trapezius	Deep Cervical Flexors (Longus Coli/Capitus), Lower Trapezius, Rhomboids
Elevated Shoulder	Upper Trapezius, Levator Scapulae	Lower Trapezius, Rhomboids, Serratus Anterior, Rotator Cuff
Shoulder Protraction	Pectoralis Major/Minor, Latissimus Dorsi	Rhomboids, Middle/Lower Trapezius
Winged Scapula	Rhomboid, Pectoralis Minor	Serratus Anterior, Middle/Lower Trapezius
Anterior Tilt (increased lumbar lordosis)	Adductors, Iliopsoas, Rectus Femoris, Erector Spinae, Latissimus Dorsi	Gluteus Maximus/Medius, Hamstrings, Biceps Femoris, Transverse Abdominis, Internal Obliques, Multifidi, Rectus Abdominis
Posterior Tilt (increased lumbar flexion-flattened lumbar curve)	External Obliques, Rectus Abdominis, Hamstrings	Hip Flexors, Quadriceps
Iliac Crest Inequality	*Leg length discrepancy Quadratus Lumborum, Hip Flexors, Rectus Abdominus, External Obliques, Soleus, Gastrocnemius	Gluteus Maximus/Medius/Minimus, Hamstrings, Adductor Complex
Medially Rotated Hip	Gluteus Medius/Minimus, Tensor Fasciae Latae, Adductors Brevis and Longus, Superior Portion of the Adductor Magnus	Externus and Internus Obturators, Piriformis, Superior and Inferior Gemelli, Quadratus Femoris
Laterally Rotated Hip	Externus and Internus Obturators, Piriformis, Superior and Inferior Gemelli, Quadratus Femoris	Gluteus Medius/Minimus, Tensor Fasciae Latae, Adductors Brevis and Longus, Superior Portion of the Adductor Magnus
Laterally Rotated Patella	Tensor Fasciae Latae, Gluteus Minimus, Piriformis	Adductor Complex, Medial Hamstring, and Gluteus Medius/Maximus, Vastus Medialis, Anterior/Posterior Tibialis
Medially Rotated Patella	Adductor Complex, Biceps Femoris, TFL, and Vastus Lateralis	Gluteus Medius/Maximus, Hip External Rotators, Vastus Medialis, Medial Hamstring
Feet Internally Rotate	Tensor Fasciae Latae	Gluteus Medius/Minimus
Feet Externally Rotate	Soleus, Biceps Femoris, Lateral Gastrocnemius, Tensor Fasciae Latae	Medial Gastrocnemius, Medial Hamstring, Gluteus Medius/Maximus, Gracilis, Popliteus, Sartorius
Flat Foot	Gastrocnemius, Peroneals	Gluteus Medius, Anterior/Posterior Tibialis

TABLE 1.2
MUSCLE IMBALANCES AND THEIR POTENTIAL CAUSES

POSTURAL DEVIATION	TIGHT MUSCULATURE	WEAK MUSCULATURE
Elbows flex when arms are overhead during squat test	Pectoralis Major	Middle/Lower Trapezius
Arms fall forward when overhead during squat test (increased lordosis)	Latissimus Dorsi, Pectoralis Major/Minor, Teres Major, Coracobrachialis	Middle/Lower Trapezius, Rhomboids, Rotator Cuff
Low back arches during squat test	Latissimus Dorsi, Erector Spinae, Hip flexors	Gluteus Maximus, Hamstrings, Core Stabilizers
Heels elevate during squat test	Soleus	Anterior Tibialis
Hip hike during single-leg squat test	Quadratus Lumborum (opposite side of stance leg) TFL, Gluteus Minimus (same side as stance leg)	Adductor Complex (same side as stance leg), Gluteus Medius (same side as stance leg)
Hip drop during single-leg squat test	Adductor Complex (same side as stance leg)	Gluteus Medius (same side as stance leg), Quadratus Lumborum (same side as stance leg)
Inward trunk rotation during single-leg squat test	Internal Oblique (same side as stance leg), External Oblique (opposite side of stance leg), TFL (same side as stance leg), Adductor Complex (same side as stance leg)	Internal Oblique (opposite side of stance leg), External Oblique (same side as stance leg), Gluteus Medius/Maximus
Outward trunk rotation during single-leg squat test	Internal Oblique (opposite side of stance leg), External Oblique (same side as stance leg), Piriformis (same side as stance leg)	Internal Oblique (same side as stance leg), External Oblique (opposite side of stance leg), Adductor Complex (opposite side of stance leg), Gluteus Medius/Maximus

EVALUATION OF BALANCE

Lateral stabilization of the pelvis is required to maintain proper gait. The stability of the pelvis comes from the gluteus medius, gluteus maximus, and TFL. A single-leg stance test for balance can be analyzed to screen for muscle imbalances and risk of injury.

Have your client raise one hip to 45-90° while bending the knee to 90°. Observe the quality of their movement.

1) Is there any shifting while trying to attain the desired stance? Is there any unevenness in their pelvis or shoulders?

2) The client should be able to hold this stance without any compensation for at least 15 seconds.

3) If you notice any of the following while trying to attain stance position, there may be possible dysfunction.

- Excessive shifting of the pelvis
- Inability to hold the stance for 15 seconds
- Elevated contralateral shoulder
- Elevated contralateral hip
- Medial rotation of the femur

If the knee is medially rotating, it may be that the TFL and medial hip rotators are dominant to the inhibited and weaker gluteus medius/minimus, and hip lateral rotators. We can generalize this by saying that the adductors are dominant to the abductors. In this case, choose exercises that focus on strengthening the hip abductors and avoid hip adduction until the medial rotation seems to be corrected. The reverse would apply if the femur was laterally rotated.

At this point you should do the modified Thomas test and the Trendelenberg test to confirm your findings and help you to determine the correct balance of stretching vs. strengthening exercises. The modified Thomas test allows you to assess the lower extremity muscles that are especially prone to tightness. They include the iliacus and psoas major, and the rectus femoris and TFL-ITB. If the hip flexors are tight it will limit hip extension and may cause an anterior pelvic tilt. Coupled with the tight hip flexors, you will most likely find weak gluteus maximus. A positive Trendelenburg test can occur when there is presence of a muscular dysfunction (weakness of the gluteus medius or minimus) or when someone is experiencing pain. The body is not able to maintain the center of gravity on the side of the stance leg.

MODIFIED THOMAS TEST

Have your client sit on the very edge of the table or exercise bench with the coccyx touching the table and one foot on the floor **(FIGURE 1A).** Help them to carefully roll onto their back while helping to support their midthoracic spine and keeping their knees drawing into their chest. Make sure that their spine is in neutral (not arched) and that their pelvis is in posterior rotation to fix the origin of the hip flexors. They should maintain this position during the evaluation.

While maintaining hip flexion, passively lower the clients' leg until you detect resistance in the leg being tested **(FIGURE 1B).** Once you determine the resting position, look at the thigh from the side to see if it is parallel (180°) to the table or exercise bench, or if it is less than 180°. The greater the hip flexion in the leg being tested, the tighter the iliacus and psoas muscles will be.

Now look at the angle of the knee. The normal angle should be 90°. If the angle is greater than 90°, it is most likely due to tightness in the rectus femoris. With both the hip flexors and the quadriceps, the degree of the angle will reflect the amount of tightness in that area.

Position yourself at the end of the table or exercise bench, facing your client **(FIGURE 1C)**. Is the femur in a straight line with the patella centered? If the tested leg and respective patella are laterally rotating, it suggests that there is tightness in the TFL-ITB. This can be further confirmed when you passively move the tested leg into neutral and there is an increase in hip flexion.

FIGURE 1A

FIGURE 1B

FIGURE 1C

MODIFIED 30-SECOND SIT TO STAND TEST

Sit-to-stand tests measure a clinically relevant function and are widely used in older adult populations. The modified 30-second sit-to-stand test overcomes the floor effect of other sit-to-stand tests observed in physically challenged older adults.

This is an important test of the client's functional ability to perform essential activities like getting up from the toilet, out of bed, and out of a chair.

Purpose: to assess functional lower extremity strength and endurance, transitional movements, balance, and fall risk.

Equipment: a chair with a straight back without arm rests (seat 17" high), and a stopwatch.

Instruct your client to:

1) Sit in the middle of the chair.
2) Place their hands on their opposite shoulders – crossed at the wrists.
3) Keep their feet flat on the floor.
4) Keep their back straight, and arms against their chest.
5) On "Go," rise to a full standing position, then sit back down again. Repeat this for 30 seconds.

On the word "Go," begin timing.

1) If the client must use his/her arms to stand, stop the test. Record "0" for the number and score.
2) Count the number of times the patient comes to a full standing position in 30 seconds.
3) If the patient is over halfway to a standing position when 30 seconds have elapsed, count it as a stand.
4) Record the number of times the patient stands in 30 seconds.

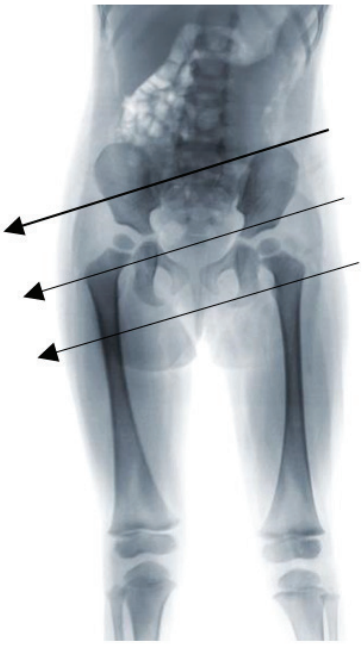
Below Average Scores

AGE	MEN	WOMEN
60-64	<14	<12
65-69	<12	<11
70-74	<12	<10
75-79	<11	<10
80-84	<10	<9
85-89	<8	<8
90-94	<7	<7

** A below average score indicates a risk for falls.*

TRENDELENBURG TEST

A physical examination finding associated with various hip abnormalities (those associated with abduction muscle weakness or hip pain or congenital hip dislocation, hip rheumatoid arthritis/osteoarthritis) in which the pelvis sags on the side opposite the affected side during single leg stance on the affected side. During gait, compensation occurs by leaning the torso toward the involved side during stance phase on the affected extremity.



If you have a client who you suspect has a hip abductor weakness, and also presents with foot over-pronation, a baseline gluteus medius strength assessment is necessary.

Have the client stand on one foot for 30 seconds. Look at frontal plane pelvis alignment. If you notice a drop in the hip on the contralateral side of the stance leg, that would be a ***positive Trendelenburg test.*** The muscle weakness is present on the side of the stance leg.

A Trendelenburg sign can occur when there is presence of a muscular dysfunction (weakness of the gluteus medius or minimus) or when someone is experiencing pain. The body is not able to maintain the center of gravity on the side of the stance leg. Normally, the body shifts the weight to the stance leg, allowing the shift of the center of gravity and consequently stabilizing or balancing the body. However, in this scenario, when the client lifts the opposing leg, the shift is not created and the client cannot maintain balance, leading to instability.

RECOMMENDED EXERCISES FOR POSITIVE TRENDELENBURG TEST:

Single Leg Squat

- Beginning in a single leg stance, instruct your client to lower to a 45 degree of knee flexion
- Have them hold this position for 5 seconds while trying to maintain frontal plane hip and knee alignment
- Repeat 5-10 times

Clams

- Have client lie on their side, with head propped up
- Legs should be bent, feet stacked on top of one another, and circular band should be positioned above knees
- Instruct your client to raise the top leg, pulling against the band, and hold at the top for 1-3 seconds
- Have them lower their leg slowly back to starting position and then repeat 12-15 times
- Repeat 12-15 times on other side

Pelvic Drop

- Have the client stand on the “stance” leg on a small step
- Allow the foot on the opposite leg to drop below the height of the step, causing the pelvis to drop
- Instruct them to exhale as they bring the foot up to the level of the step and level out the pelvis
- Repeat 10 times

OVERHEAD SQUAT ASSESSMENT (OHSA) TEST PROTOCOL

Purpose: to assess dynamic flexibility, core strength, balance, and overall neuromuscular control.
Equipment: none

Procedures:

Position

- Have your client remove their shoes and socks.
- Instruct them to stand with their feet shoulder-width apart and pointing straight ahead.
- Ask them to raise their arms overhead, with elbows fully extended. If your client is unable to do this, or if it is causing any pain, you can conduct the test with their arms crossed over their chest. You will only be able to analyze their lower body under these circumstances.

Movement

- Instruct them to squat as if they were going to sit in a chair and then return to starting position *slowly.*
- Have them repeat the process for 5 repetitions while you observe them from the anterior, lateral, and posterior positions.
  - From the front you can view their feet, ankles, and knees. Their feet should point straight forward with the knees tracking in line with the foot. You can also look at the achilles tendons from the back. They should be almost perpendicular to the floor (FIGURE 2C).
  - From the side you can view their lumbo-pelvic hip complex, shoulder, and cervical spine. The tibia and arms should stay in line with the torso (FIGURE 2A and 2B).
  - From behind you can view the foot and ankle complex, knee valgus and varus (FIGURE 2D and 2E), and the lumbo-pelvic hip complex. It is normal for the foot and ankle complex to demonstrate slight pronation, but the arch should remain *visible*. The feet should continue to point straight ahead and the heels should remain in contact with the floor. There should be no shifting from side to side in the lumbo-pelvic hip complex.

FIGURE 2A

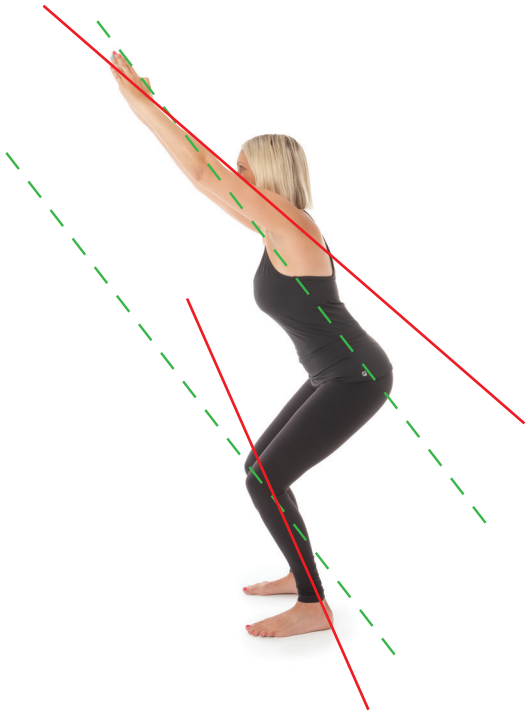


FIGURE 2B

Optimal Positioning

Client Positioning

FIGURE 2C

FIGURE 2D

FIGURE 2E

AFTER WATCHING THEIR MOVEMENT PATTERN YOU CAN DERIVE THE FOLLOWING:

LOOKING AT YOUR CLIENT FROM THE FRONT

**LPHC – Lumbo pelvic hip complex*

CHECKPOINT	COMPENSATION	OVERACTIVE MUSCLES	UNDERACTIVE MUSCLES
Foot	Foot turns out	Soleus, Lateral Gastrocnemius, Bicep Femoris (short head), Tensor Fascia Latae	Medial Gastrocnemius, Medial Hamstring, Gluteus Medius/Maximus, Gracilis, Popliteus
Knee	Moves inward	Adductor Complex, Bicep Femoris (short head), Tensor Fascia Latae, Vastus Lateralis, Lateral Gastrocnemius	Gluteus Medius/Maximus, Vastus Medialis Oblique (VMO), Medial Hamstring, Medial Gastrocnemius
Knee	Moves outward	Piriformis, Biceps Femoris, Tensor Fascia Latae, Gluteus Minimus/Medius	Adductor Complex, Medial Hamstring, Gluteus Maximus

Looking at your client from the side

CHECKPOINT	COMPENSATION	OVERACTIVE MUSCLES	UNDERACTIVE MUSCLES
LPHC	Excessive forward lean	Soleus, Gastrocnemius, Hip Flexor Complex, Abdominal Complex (rectus abdominus, external oblique)	Anterior Tibialis, Gluteus Maximus, Erector Spinae
LPHC	Low back arches	Hip Flexor Complex, Erector Spinae, Latissimus Dorsi	Gluteus Maximus, Hamstrings, Intrinsic Core Stabilizers (transverse abdominis, multifidus, internal oblique, transversospinalis, pelvic floor muscles
LPHC	Low back rounds	Hamstrings, Adductor Magnus, Rectus Abdominus, External Obliques	Gluteus Maximus, Erector Spinae, Intrinsic Core Stabilizers (transverse abdominis, multifidus, internal oblique, pelvic floor muscles, transversospinalis)
Upper body	Arms fall forward	Latissumus Dorsi, Pectoralis Major/Minor, Teres Major, Coracobrachialis	Mid/Lower Trapezius, Rhomboids, Rotator Cuff, Posterior Deltoid
Upper body	Forward head	Levator Scapula, Sternocleidomastoid, Scalenes	Deep Cervical Flexors
Upper body	Shoulder elevation	Upper Trapezius, Sternocleidomastoid, Levator Scapulae	Mid/Lower Trapezius, Rhomboids, Rotator Cuff

Looking at your client from the back

CHECKPOINT	COMPENSATION	OVERACTIVE MUSCLES	UNDERACTIVE MUSCLES
Foot	Foot flattens	Peroneals, Lateral Gastrocnemius, Bicep Femoris (short head), Tensor Fascia Latae	Anterior Tibialis, Posterior Tibialis, Medial Gastrocnemius, Gluteus Medius
LPHC	Heel rises	Soleus	Anterior Tibialis
LPHC	Asymmetrical weight shift	Adductor Complex, Tensor Fascia Latae (same side), Piriformis, Bicep Femoris, Gluteus Medius (opposite side)	Gluteus Medius (same side), Adductor Complex (opposite side)

TABLE 1.3
BIOMECHANICS

MUSCLE STRUCTURE	ORIGIN	INSERTION	MOVEMENT
Pectoralis Major	Clavicular head: anterior surface of medial half of clavicle; Sternocostal head: anterior surface of sternum, superior six costal cartilages, and aponeurosis of external oblique muscle	Lateral lip of intertubercular groove of humerus	Adducts and medially rotates humerus; draws scapula anteriorly and inferiorly; Acting alone: clavicular head flexes humerus and sternocostal head extends it; Ball and socket joint
Pectoralis Minor	3rd to 5th ribs near their costal cartilages	Medial border and superior surface of coracoid process of scapula	Stabilizes scapula by drawing it inferiorly and anteriorly against thoracic wall
Deltoid	Lateral third of clavicle, acromion, and spine of scapula	Deltoid tuberosity of humerus	Anterior part: flexes and medially rotates arm; Middle part: abducts arm; Posterior part: extends and laterally rotates arm
Serratus Anterior	Superolateral surfaces of upper 8 or 9 ribs at the side of chest	Vertebral border of scapula	Draws scapula forward and upward; abducts scapula and rotates it; stabilizes vertebral border of scapula
Rectus Abdominis	Pubic crest and symphysis pubis	Ribs (5th, 6th, & 7th), Xiphoid Process	Rectus Abdominis controls the tilt of the pelvis and curvature of the lower spine. It also tilts pelvis forward improving the mechanical positioning of the erector spinae.
External Obliques	External surfaces of ribs 5-12	Anterior iliac crest and abdominal aponeurosis to linea alba	Flexes vertebral column (draws thorax downwards); rotates vertebral column (torso); laterally flexes vertebral column; compresses abdomen
Internal Obliques	Anterior iliac crest , lateral half of the inguinal ligament, and thoracolumbar fascia	Costal cartilages of ribs 8-12, abdominal aponeurosis to linea alba	Flexes vertebral column(draws thorax downwards); rotates vertebral column(torso)
Transverse Abdominis	Anterior iliac crest , lateral half of the inguinal ligament, and thoracolumbar fascia and cartilages of ribs 6-12	Abdominal aponeurosis to linea alba, xiphoid process and pubic symphysis	Compresses the abdomen
Multifidis	Posterior surface of the sacrum, Articular processes of the lumbar vertebrae, Transverse processes of the thoracic vertebrae, Articular processes of C3-7	Each part of the muscle inserts into the spinous process 2-4 vertebrae higher than its origin	Extension, lateral flexion and rotation of the spine
Quadratus Lumborum	Posterior iliac crest and Iliolumbar ligament	Twelfth rib and transverse processes of L1-L4	Laterally flexes (side-bends) trunk
Pectineus	Upper front of the pubic bone	Upper medial shaft of the femur, inferior to the lesser trochanter	Hip adduction and Hip flexion
Iliopsoas	Inner surface the Ilium base of the sacrum, vertebral column (lateral surface) of thoracic vertebrae (T-12), lumbar vertebrae (L1-5) and intervertebral discs	Femur-lesser trochanter and shaft below lesser trochanter, tendon of psoas major & femur	Hip flexion and spine rotation

MUSCLE STRUCTURE	ORIGIN	INSERTION	MOVEMENT
Biceps Brachii	Short head: tip of coracoid process of scapula; long head: supraglenoid tubercle of scapula	Tuberosity of radius and fascia of forearm via bicipital aponeurosis	Supinates forearm and, when it is supine, flexes forearm
Brachialis	Distal half of anterior surface of humerus	Coronoid process and tuberosity of ulna	Major flexor of forearm - flexes forearm in all positions
Brachioradialis	Proximal 2/3 of lateral supracondylar ridge of humerus	Lateral surface of distal end of radius	Flexes forearm
Supinator	Lateral epicondyle of humerus, radial collateral and annular ligaments, supinator fossa and crest of ulna	Lateral, posterior and anterior surfaces of proximal 1/3 of radius	Supinates forearm (i.e., rotates radius to turn palm anteriorly)
Pronator Teres	Medial epicondyle of humerus and coronoid process of ulna	Middle of lateral surface of radius	Pronates and flexes forearm (at elbow)
Pronator Quadratus	Distal 1/4 of anterior surface of ulna	Distal 1/4 of anterior surface of radius	Pronates forearm; deep fibers bind radius and ulna together
Palmeris Longus	Medial epicondyle of humerus	Distal half of flexor retinaculum and palmar aponeurosis	Flexes hand (at wrist) and tightens palmar aponeurosis
Flexor Carpi Ulnaris	Humeral head: medial epicondyle of humerus; Ulnar head: olecranon and posterior border ulna	Pisiform bone, hook of hamate bone, and 5th metacarpal bone	Flexes and adducts hand (at wrist)
Flexor Carpi Radialis	Medial epicondyle of humerus	Base of 2nd metacarpal	Flexes and abducts hand (at wrist)
Vastus Lateralis	Superior portion of intertrochanteric line, anterior and inferior borders of greater trochanter, superior portion of lateral lip of linea aspera, and lateral portion of gluteal tuberosity of femur	Lateral base and border of patella; also forms the lateral patellar retinaculum and lateral side of quadriceps femoris tendon	Extends the knee
Rectus Femoris	Straight head from anterior inferior iliac spine; reflected head from groove just above acetabulum	Base of patella to form the more central portion of the quadriceps femoris tendon	Extends the knee
Vastus Medialis	Inferior portion of intertrochanteric line, spiral line, medial lip of linea aspera, superior part of medial supracondylar ridge of femur, and medial intramuscular septum	Medial base and border of patella; also forms the medial patellar retinaculum and medial side of quadriceps femoris tendon	Extends the knee
Vastus Intermedius	Superior 2/3 of anterior and lateral surfaces of femur; also from lateral intramuscular septum of thigh	Lateral border of patella; also forms the deep portion of the quadriceps tendon	Extends the knee
Adductor Longus	Anterior surface of body of pubis, just lateral to pubic symphysis	Middle1/3 of linea aspera, between the more medial adductor magnus and brevis insertions and the more lateral origin of the vastus medialis	Adducts and flexes the thigh, and helps to laterally rotate the hip joint
Adductor Brevis	Anterior surface of inferior pubic ramus, inferior to origin of adductor longus	Pectineal line and superior part of medial lip of linea aspera	Adducts and flexes the thigh, and helps to laterally rotate it

MUSCLE STRUCTURE	ORIGIN	INSERTION	MOVEMENT
Adductor Magnus	Inferior pubic ramus, ischial ramus, and inferolateral area of ischial tuberosity	Gluteal tuberosity of femur, medial lip of linea aspera, medial supracondylar ridge, and adductor tubercle	Powerful thigh adductor; superior horizontal fibers also helps flex the thigh, while vertical fibers help extend the thigh
Tibialis Anterior	Lateral condyle of tibia, proximal 1/2 - 2/3 or lateral surface of tibial shaft, interosseous membrane, and the deep surface of the fascia cruris	Medial and plantar surfaces of 1st cuneiform and on base of first metatarsal	Dorsiflexor of ankle and invertor of foot
Tibialis Posterior	Posterior aspect of interosseous membrane, superior 2/3 of medial posterior surface of fibula, superior aspect of posterior surface of tibia, and from intramuscular septum between muscles of posterior compartment and deep transverse septum	Splits into two slips after passing inferior to plantar calcaneonavicular ligament; superficial slip inserts on the tuberosity of the navicular bone and sometimes medial cuneiform; deeper slip divides again into slips inserting on plantar surfaces of metatarsals 2 - 4 and second cuneiform	Principal invertor of foot; also adducts foot, plantar flexes ankle, and helps to supinate the foot
Extensor Digitorum Longus	Lateral condyle of fibula, upper 2/3 - 3/4 of medial fibular shaft surface, upper part of interosseous membrane, fascia cruris, and anterior intramuscular septum	Splits into 4 tendon slips after inferior extensor retinaculum, each of which insert on dorsum of middle and distal phalanges as part of extensor expansion complex	Extend toes 2 - 5 and dorsiflexes ankle
Peroneus Tertius	Arises with the extensor digitorum longus from the medial fibular shaft surface and the anterior intramuscular septum (between the extensor digitorum longus and the tibialis anterior)	Dorsal surface of the base of the fifth metatarsal	Works with the extensor digitorum longus to dorsiflex, evert and abduct the foot
Peroneus Longus	Head of fibula, upper 1/2 - 2/3 of lateral fibular shaft surface; also anterior and posterior intra-muscular septa of leg	Plantar posterolateral aspect of medial cuneiform and lateral side of 1st metatarsal base	Everts foot and plantar flexes ankle; also helps to support the transverse arch of the foot
Peroneus Brevis	Inferior 2/3 of lateral fibular surface; also anterior and posterior intramuscular septa of leg	Lateral surface of styloid process of 5th metatarsal base	Everts foot and plantar flexes ankle
Levator Scapulae	Posterior tubercles of transverse processes of C1 - C4 vertebrae	Superior part of medial border of scapula	Elevates scapula and tilts its glenoid cavity inferiorly by rotating scapula
Trapezius	Medial third of superior nuchal line; external occipital protuberance, nuchal ligament, and spinous processes of C7 - T12 vertebrae	Lateral third of clavicle, acromion, and spine of scapula	Elevates, retracts and rotates scapula; superior fibers elevate, middle fibers retract, and inferior fibers depress scapula; superior and inferior fibers act together in superior rotation
Lattisimus Dorsi	Spinous processes of inferior 6 thoracic vertebrae, thora-columbar fascia, iliac crest, and inferior 3 or 4 ribs	Floor of intertubercular groove of humerus	Extends, adducts, and medially rotates humerus; raises body toward arms during climbing
Supraspinatus	Supraspinous fossa of scapula	Superior facet on greater tuberosity of humerus	Initiates and assists deltoid in abduction of arm and acts with other rotator cuff muscles

MUSCLE STRUCTURE	ORIGIN	INSERTION	MOVEMENT
Infraspinatus	Infraspinous fossa of scapula	Middle facet on greater tuberosity of humerus	Laterally rotate arm; helps to hold humeral head in glenoid cavity of scapula
Teres Major	Dorsal surface of inferior angle of scapula	Medial lip of intertubercular groove of humerus	Adducts and medially rotates arm
Teres Minor	Superior part of lateral border of scapula	Inferior facet on greater tuberosity of humerus	Laterally rotate arm; helps to hold humeral head in glenoid cavity of scapula
Subscapularis	Subscapular fossa of scapula	Lesser tuberosity of humerus	Medially rotates arm and adducts it; helps to hold humeral head in glenoid cavity of scapula
Rhomboids	Minor: nuchal ligament and spinous processes of C7 and T1 vertebrae; Major: spinous processes of T2 - T5 vertebrae	Medial border of scapula from level of spine to inferior angle	Retract scapula and rotate it to depress glenoid cavity; fix scapula to thoracic wall
Triceps Brachii	Long head: infraglenoid tubercle of scapula; Lateral head: posterior surface of humerus, superior to radial groove; Medial head: posterior surface of humerus, inferior to radial groove	Proximal end of olecranon process of ulna and fascia of forearm	Chief extensor of forearm; long head steadies head of abducted humerus
Gluteus maximus	Gluteal surface of ilium, lumbar fascia, sacrum, sacrotuberous ligament	Gluteal tuberosity of the femur, iliotibial tract	External rotation and extension of the hip joint, supports the extended knee through the iliotibial tract, chief antigravity muscle in sitting
Gluteus Medius	Gluteal surface of ilium, under gluteus maximus	Greater trochanter of the femur	Abduction of the hip; preventing adduction of the hip. Medial rotation of thigh.
Gluteus Minimus	Gluteal surface of ilium, under gluteus medius.	Greater trochanter of the femur	Works in concert with gluteus medius: abduction of the hip; preventing adduction of the hip. Medial rotation of thigh.
Biceps Femoris	Common tendon with semitendinosus from superior medial quadrant of the posterior portion of the ischial tuberosity	Primarily on fibular head; also on lateral collateral ligament and lateral tibial condyle	Flexes the knee, and also rotates the tibia laterally; long head also extends the hip joint
Semimembranosus	Superior lateral quadrant of the ischial tuberosity	Posterior surface of the medial tibial condyle	Extends the thigh, flexes the knee, and also rotates the tibia medially, especially when the knee is flexed
Semitendinosus	From common tendon with long head of biceps femoris from superior medial quadrant of the posterior portion of the ischial tuberosity	Superior aspect of medial portion of tibial shaft	Extends the thigh and flexes the knee, and also rotates the tibia medially, especially when the knee is flexed
Gracilis	Inferior margin of pubic symphysis, inferior ramus of pubis, and adjacent ramus of ischium	Medial surface of tibial shaft, just posterior to Sartorius	Flexes the knee, adducts the thigh, and helps to medially rotate the tibia on the femur

MUSCLE STRUCTURE	ORIGIN	INSERTION	MOVEMENT
Gastrocnemius	Medial head from posterior nonarticular surface of medial femoral condyle; Lateral head from lateral surface of femoral lateral condyle	The two heads unite into a broad aponeurosis which eventually unites with the deep tendon of the soleus to form the Achilles tendon, inserting on the middle 1/3 of the posterior calcaneal surface	Powerful plantar flexor of ankle
Soleus	Posterior aspect of fibular head, upper 1/4 - 1/3 of posterior surface of fibula, middle 1/3 of medial border of tibial shaft, and from posterior surface of a tendinous arch spanning the two sites of bone origin	Eventually unites with the gastrocnemius aponeurosis to form the Achilles tendon, inserting on the middle 1/3 of the posterior calcaneal surface	Powerful plantar flexor of ankle
Extensor Carpi Ulnaris	Lateral epicondyle of humerus and posterior border of ulna	Base of 5th metacarpal	Extends and adducts hand at wrist joint
Extensor Carpi Radialis Longus	Lateral supracondyle ridge of humerus	Base of 2nd metacarpal	Extend and abduct hand at wrist joint
Extensor Carpi Radialis Brevis	Lateral epicondyle of humerus	Base of 3rd metacarpal	Extend and abduct hand at wrist joint
Erector Spinae	Spinous processes of T9-T12 thoracic vertebra	Spinous processes of T1 and T2 thoracic vertebrae and the cervical vertebrae	
Temporalis	Temporal lines, temporal fossa and temporal fascia	Tips and medial surface of coronoid process of the mandible	Elevates and retracts mandible at temporomandibular joint to close jaw
Frontalis	Galea apneurotica	Skin around eyebrows and nose	Raises eyebrows and wrinkles forehead as it draws scalp back
Orbicularis oculi	Frontal bone; medial palpebral ligament; lacrimal bone	Ateral palpebral raphe	Closes eyelids
Masseter	Zygomatic arch and maxilla	Coronoid process and ramus of mandible	elevation (as in closing of the mouth) and retraction of mandible
Sternocleidomastoid	Manubrium sterni, medial portion of the clavicle	Mastoid process of the temporal bone, superior nuchal line	Acting alone, tilts head to its own side and rotates it so the face is turned towards the opposite side. Acting together, flexes the neck, raises the sternum and assists in forced inspiration.

CHAPTER SEVEN

CARDIORESPIRATORY FITNESS IN ADULT CANCER CLIENTS

Cardiorespiratory Testing

Objective: to determine the level of patient's cardiovascular fitness through exercise testing and to know when to refer the patient to their primary caregiver for further testing of cardiotoxicity. This will help you to:

- Understand cardiopulmonary function
- Understand absolute and relative contraindications for exercise testing
- Understand how and when to perform cardiorespiratory testing

Goal: to design an exercise program that is safe and effective for the clients' individual needs that takes into consideration any pre-existing medical conditions and their current/previous level of conditioning.

WHAT IS CARDIORESPIRATORY FITNESS?

In recent years, exercise has become part of the standard of care during the treatment, recovery, and survivorship of cancer clients. Formalized exercise guidelines have been established by several national and international agencies such as the American Cancer Society, the European Respiratory Society, and the American Thoracic Society/American College of Chest Physicians.

As exercise professionals, cardiorespiratory testing can help us to:

- Create individualized exercise programming for clients with cancer
- Determine whether your programming is effective in promoting positive change

Cardiopulmonary function is the interrelationship between the lungs, the heart, and the blood system. Its primary function is the regulation of blood flow between the heart and lungs through the pulmonary artery. During exercise, it allows the body to receive freshly oxygenated blood to the active skeletal muscles. There are two inter-related cardio-centered systems in the human body; cardiovascular and cardiorespiratory. The cardiovascular system regulates the flow of blood throughout the body while the cardiorespiratory system describes the function of the heart in relationship to the entire breathing process from the nose and throat to the lungs.

The efficiency of heart function depends on the strength of the heart muscle. We know that chemotherapy and radiation can have a detrimental effect on both the heart and lungs. Several chemotherapy drugs may cause cardiac toxicity, but the most common cause of cardiac toxicity in cancer clients is treatment with chemotherapy drugs called anthracyclines. Doxorubicin (Adriamycin®) is a frequently prescribed anthracycline. Anthracyclines may be used to treat leukemia, lymphoma, multiple myeloma and breast cancer.

Cardiac toxicity may cause arrhythmias or it can develop into heart failure. Heart failure means that the heart cannot pump with enough force to supply the body with blood containing essential oxygen and nutrients. Heart failure develops over time as the pumping action of the heart grows weaker.

Cardiac toxicity is diagnosed with a number of examinations and tests:

Heart sounds - an extra sound other than the normal heart beat is called a murmur, and may be a sign that the heart is damaged.

Chest X-ray - provides a one-dimensional picture of the heart and lungs. An enlarged heart on a chest x-ray may indicate that the heart muscle is damaged.

Electrocardiogram (ECG) - ECG machine records the electrical activity of the heart. This test is used to measure the rate and regularity of the heartbeat.

Echocardiogram - uses sound waves to create a picture of the heart. It shows how well the heart is filling with blood and pumping it to the rest of the body.

Multi Gated Acquisition (MUGA) scan - takes specialized pictures of the heart after a radioactive substance is injected into a vein. The contraction and relaxation of the heart and blood supply to the heart can be visualized from the pictures.

If your client presents with any of the following, they should notify their doctor immediately as these may be signs of cardiac toxicity:

- Excessive fatigue
- Shortness of breath on exertion worsening to shortness of breath at rest
- Discomfort lying on their back
- Swelling of their ankles

CONTRAINDICATIONS FOR EXERCISE TESTING

Absolute

- Acute myocardial infarction within (3-5 days)
- Unstable angina
- Uncontrolled arrhythmias causing symptoms or hemodynamic compromise
- Syncope
- Active endocarditis
- Acute myocarditis
- Symptomatic severe aortic stenosis
- Uncontrolled heart failure
- Acute pulmonary embolus or pulmonary infarction
- Thrombosis of lower extremities
- Uncontrolled asthma
- Pulmonary edema
- Room air desaturation at rest ≤ 85%
- Respiratory failure
- Acute noncardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)
- Mental impairment leading to inability to cooperate
- Evidence of extensive metastases

Relative

- Left main coronary stenosis or its equivalent
- Moderate stenotic valvular heart disease
- Severe untreated arterial hypertension at rest (>200 mm Hg systolic, >120 mm Hg diastolic)
- Tachyarrhythmias or bradyarrhythmias
- High-degree atrioventricular block
- Hypertrophic cardiomyopathy
- Significant pulmonary hypertension
- Advanced or complicated pregnancy
- Electrolyte abnormalities
- Orthopedic impairment that compromises exercise performance
- Untreated anemia

Adapted from American Thoracic Society/American College of Chest Physicians, 2003, "ATS/ACCP Statement on cardiopulmonary exercise testing." American Journal of Respiratory and Critical Care Medicine 167(2):211-77.

CARDIORESPIRATORY TESTING METHODS

As fitness professionals, we are taught to compare our clients' test results to age-matched norms. This method will be ineffective for cancer clients because there are so many factors affecting their performance that the average, healthy individual, does not contend with. These may include cancer-related fatigue, shortness of breath, dizziness, balance issues, anemia, peripheral neuropathy, pain, and chemotherapy/radiation-induced cardiomyopathy.

Prior to beginning any exercise testing or programming with a client, it is imperative that you receive a medical clearance from their primary oncologist or general practitioner. Their attending physician should prescribe an initial, medically supervised, cardiovascular screening and/or stress test. Exercise constitutes a physiologic stress that may pose a greater risk to people with cancer than to people without pathology or impairment. The space for testing must be sufficient to minimize injury should the patient fall or have an arrest. All fitness professionals should have current CPR certification.

The initial appointment with your client should consist of a thorough evaluation of their entire health/medical history, balance, postural assessment, range of motion (flexibility), girth measurements (lymphedema), resting heart rate, resting blood pressure, and cardiorespiratory fitness. The average cancer patient may be older than your typical client and, therefore, present with a wide range of orthopedic and other health issues that need to also be taken into consideration.

Advise your client to avoid caffeinated beverages (coffee, tea, soda, energy drinks…), smoking, or exercising, prior to their assessment. Make sure that you familiarize yourself with any medication that they are taking that may have an effect on their heart rate and exercise response.

There are two types of cardiorespiratory tests that can be done; maximal and submaximal. The decision to use a maximal or submaximal exercise test depends on the reasons for the test, risk level of the client, and availability of necessary equipment and medical supervision. Maximal tests require participants to exercise to the point of volitional fatigue, which might entail the need for medical supervision.

Personal trainers commonly rely on submaximal exercise tests because maximal exercise testing is not always feasible in health club or studio setting. The submaximal test will predict cardiorespiratory fitness based on the workload achieved at a predetermined submaximal heart rate. Submaximal testing can be challenging with cancer clients because of various cancer therapies and medications that can affect heart rate.

Objective goals can also be quite effective in determining the appropriate exercise prescription for a given client. A normal exercise response might be the reduction of the resting and/or working heart rate of an individual over time. Typically, we are able to gradually increase the intensity and duration of an exercise as the client adapts to their previous level. If you do not see a notable improvement in exercise response, that should alert you to the fact that there may be an underlying problem. At this point, gently suggest that the client be evaluated by their attending physician to rule out any heart and/or lung damage.

Be very delicate with your approach, so as not to alarm your client, although they are usually well aware of the risks associated with their treatments. You want them to know that you are looking out for their best interests.

Accurate measurement of heart rate is critical for valid submaximal testing. You can certainly use manual palpation, however, there is a greater risk of error if you are not an experienced evaluator. Try using a heart rate monitor as it can reduce a significant source of error in the test. In addition to the medications and treatments that your clients are taking/undergoing, there are several other factors that can affect the outcome. The submaximal heart rate can also be affected by heat and humidity as well as the aforementioned; smoking, caffeine, and exercise prior to the testing.

The two standard tests that are used are the treadmill test and the cycle ergometer. While walking is a more natural activity than cycling is for most people, it can pose additional challenges for the cancer patient whose balance and coordination may be affected by treatment. The safety of our client is the highest priority and should be considered when choosing the testing modality. A cycle ergometer will, of course, require less coordination and balance than a treadmill.

Make sure that when you re-evaluate your client every 8-12 weeks that the same method of testing is used, under the same circumstances (time of day, environment, etc.)

The Bruce Protocol is a maximal exercise test where the patient works to complete exhaustion as the treadmill speed and incline is increased every three minutes. The length of time on the treadmill is the test score and can be used to estimate the VO2 max value. During the test, heart rate, blood pressure and ratings of perceived exertion are often also collected. **For clients undergoing treatment, or lower functioning clients, use the Modified Bruce Protocol**.

Modified Bruce Protocol - starts at a lower workload than the standard test, and is typically used for elderly or sedentary clients. Standard **Bruce protocol** test has 7 three minute stages. First stage starts at a speed of 1.7 miles per hour (mph) and a gradient of 10%. Each subsequent stage has an increment of 0.7 to 0.8 mph in speed and 2% in gradient. The first two stages of the Modified Bruce Test are performed at a 1.7 mph and 0% grade and 1.7 mph and 5% grade, and the third stage corresponds to the first stage of the Standard Bruce Test protocol as listed above.

Stage 1 = 1.7 mph at 0% Grade
Stage 2 = 1.7 mph at 5% Grade
Stage 3 = 1.7 mph at 10% Grade
Stage 4 = 2.5 mph at 12% Grade
Stage 5 = 3.4 mph at 14% Grade
Stage 6 = 4.2 mph at 16% Grade
Stage 7 = 5.0 mph at 18% Grade

The American College of Cardiology (ACC)/American Heart Association (AHA) guidelines specify indications for termination of exercise testing. **Absolute indications for termination of testing include the following:**

- Drop in systolic blood pressure (SBP) of more than 10 mm Hg from baseline, despite an increase in workload, when accompanied by other evidence of ischemia (shortness of breath, extreme fatigue, dizziness, lightheadedness, fainting, chest pain, heart palpitations, swelling in the legs, feet, or abdomen)
- Moderate-to-severe angina (chest pain)
- Increasing nervous system symptoms (eg, lack of coordination, dizziness, close to fainting)
- Signs of poor perfusion (blue or purple colored skin or paleness)
- Patient's desire to stop
- Sustained ventricular tachycardia (faster than normal heart rate)

RESULTS:

ACTIVE AND SEDENTARY MEN (Foster et al. 1984)

From the total walk/run time an estimate of the athlete's VO2 max can be calculated as follows:

- **VO2 max = 14.8 - (1.379 × T) + (0.451 × T^2) - (0.012 × T^3)**

"T" is the total time of the test expressed in minutes and fractions of a minute (13 minutes 15 seconds = 13.25 minutes)

ACTIVE AND SEDENTARY WOMEN (Pollock et al. 1982)

From the total walk/run time an estimate of the athlete's VO2 max can be calculated as follows:

- **VO2 max = 4.38 × T - 3.9**

"T" is the total time of the test expressed in minutes and fractions of a minute.

Maximal oxygen uptake norms for men (ml/kg/min)

RATING	18-25 AGE (YEARS)	26-35	36-45	46-55	56-65	65+
excellent	> 60	> 56	> 51	> 45	> 41	> 37
good	52-60	49-56	43-51	39-45	36-41	33-37
above average	47-51	43-48	39-42	36-38	32-35	29-32
average	42-46	40-42	35-38	32-35	30-31	26-28
below average	37-41	35-39	31-34	29-31	26-29	22-25
poor	30-36	30-34	26-30	25-28	22-25	20-21
very poor	< 30	< 30	< 26	< 25	< 22	< 20

Maximal oxygen uptake norms for women (ml/kg/min)

RATING	18-25 AGE (YEARS)	26-35	36-45	46-55	56-65	65+
excellent	> 56	> 52	> 45	> 40	> 37	> 32
good	47-56	45-52	38-45	34-40	32-37	28-32
above average	42-46	39-44	34-37	31-33	28-31	25-27
average	38-41	35-38	31-33	28-30	25-27	22-24
below average	33-37	31-34	27-30	25-27	22-24	19-21
poor	28-32	26-30	22-26	20-24	18-21	17-18
very poor	< 28	< 26	< 22	< 20	< 18	< 17

YMCA Submax Cycle protocol - is a multistage protocol that involves a progressive increase in workload based on the patient's heart rate response during exercise. Their VO2max can be calculated by putting the workloads and heart rates for the final two stages of the protocol into the multistage VO2max prediction equation. Cycle ergometer testing offers some advantages over Modified Bruce Protocol treadmill testing. A cycle ergometer is easy to transport, less expensive, and easier to calibrate and maintain than a treadmill. In addition, heart rate and blood pressure measurements are less difficult to obtain during exercise on the cycle. One of the major advantages of using a cycle for testing cancer clients is that the exercise is non-weightbearing and less stressful on the lower body. This is a huge plus for clients who are overweight, have orthopedic limitations, peripheral neuropathy of the feet, or struggle with balance and coordination. The biggest disadvantage is localized muscle fatigue in the legs that can limit the ability of the patient to perform exercise at higher submaximal intensities.

EQUIPMENT NEEDED:

- Bicycle Ergometer
- Metronome set at 50 or 100 bpm to help subject with cadence
- Stopwatch to time test duration (and heart rate if a monitor is not available)
- Heart-rate monitor
- Weigh scale (for use in obtaining relative O2 consumption)
- Logbook

Adjust the seat height so the patient's leg is straight when their heel is in contact with the pedal on the down stroke or lowest point of rotation. Their knee should be slightly bent when the ball of their foot is placed on the pedal at the same low point of rotation. **Record the seat position on the data sheet so that it may be used for re-testing.** The YMCA test is meant to establish the relationship between heart rate and workrate. In order to maintain the validity of the test, the two heart rates used (steady state HR from the last two workrates) in the estimation of maximal exercise capacity must be greater than 110 bpm and less than 85 percent of age-predicted maximal heart rate. The YMCA uses an upper limit of 150 bpm, which encompasses most age groups likely to be tested.

All subjects begin at 150 kg.m/min and progress according to their heart rate response at the first workrate. The metronome is set to either 100 bpm (two beats/pedal cycle) or 50 bpm (one beat/pedal cycle) to maintain a constant pedal rate throughout the test, or the client maintains a 50-rpm pedal rate using the bike's speedometer. Let the patient decide whether to use the metronome but many subjects find it difficult to maintain such a low pedaling frequency even with cadence readout from the bike, so the metronome helps somewhat.

1) In order to familiarize clients with the 50-rpm pedal rate, start the metronome (if desired) and have them pedal with very little or no resistance.

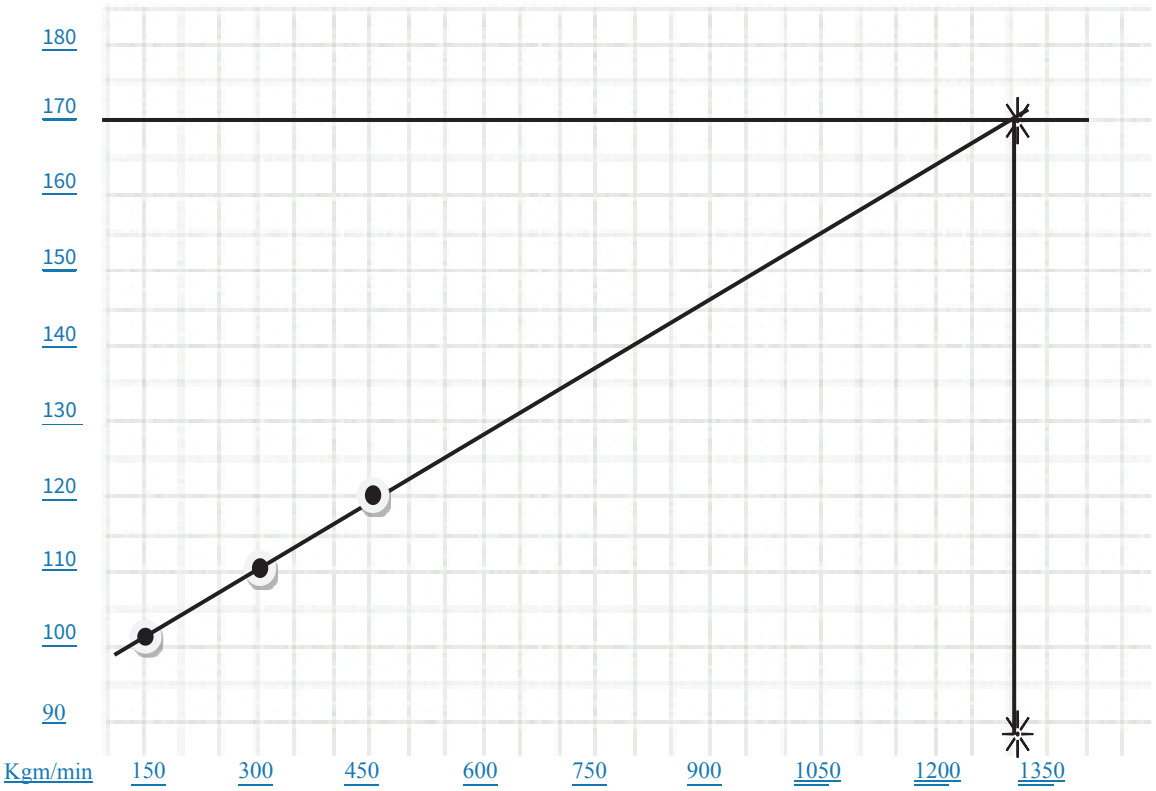
2) Start the test by setting the first workrate to 0.5 KP (150 kg.m/min) and then starting the time clock. Take heart rate reading near the end of the second and third minutes of the first stage. **A steady-state heart rate must be achieved before** progressing to the next stage (if the difference between the second-minute heart rate and the third-minute heart rate is greater than 5 bpm, the heart rate has not yet reached a steady stage and a fourth minute should be added). It may even take five minutes for the heart rate to stabilize, especially in less conditioned subjects.

3) **Be conservative** in the progression of the workrate in order to avoid driving heart rate too high. There is no need to hurry the test; each workrate (and hence steady state heart rate) is timed independently of others, so be careful to measure and record all data accurately.

4) Repeat the heart-rate monitoring guidelines used in the first stage for subsequent stages. **Continue the test until two steady-state heart rates between 110-150 bpm have been recorded for two different stages.** End the test by releasing all but 0.5-1.0 kg of resistance on the ergometer, allowing the client time to cool down (the heart rate should drop below 100 before the client stops cycling).

Interpretation - the objective of the YMCA submax bicycle test is to obtain two separate workloads resulting in steady state heart rate values between 110 bpm and the subject's 85% MHR. Steady state is determined by the last two heart rates being within 6 bpm apart. This establishes linearity between heart rate and workload for the person being tested. To establish the line of best fit on the graph, at least two points are needed. Once the test is completed, the heart rates should be plotted against the respective workload in the graph (see sample below). A straight line should be drawn through the points and extended to the subject's predicted max heart rate (220-age). The point where the diagonal line intersects the horizontal predicted max heart rate line will represent the maximal working capacity.

A perpendicular line will then be drawn from this point to the base where the maximal physical workload capacity can be read in kgm/min. This can then be used to predict a person's maximal oxygen uptake.



Sample MHR 170

CARDIOMYOPATHY

Some people have cardiomyopathy without ever having signs or symptoms, while others may not have signs or symptoms in the early stages of the disease.

Signs and symptoms of heart failure usually occur as cardiomyopathy worsens and the heart weakens. These signs and symptoms include:

- Shortness of breath or trouble breathing, especially with physical exertion
- Fatigue (tiredness)
- Swelling in the ankles, feet, legs, abdomen, and veins in the neck

Other signs and symptoms may include dizziness; light-headedness; fainting during physical activity; arrhythmias (irregular heartbeats); chest pain, especially after physical exertion or heavy meals; and heart murmurs. (Heart murmurs are extra or unusual sounds heard during a heartbeat.)

Your client may be taking any of the following medications:

- **Aldosterone blockers -** balance electrolytes in the body and help muscle and nerve tissues work properly. Abnormal electrolyte levels may be a sign of dehydration, heart failure, high blood pressure, or other disorders.
- **Antiarrhythmics -** help to prevent arrhythmias.
- **ACE inhibitors and angiotensin II receptor blockers -** lower blood pressure.
- **Anticoagulants -** prevent blood clots from forming. Blood thinners often are used to prevent blood clots from forming in people who have dilated cardiomyopathy.
- **Corticosteroids -** reduce inflammation.
- **Diuretics (water pills) -** remove excess sodium from the body and reduce the amount of fluid in the blood.
- **Beta blockers, calcium channel blockers, and digoxin -** slow your heart rate. Beta blockers and calcium channel blockers also are used to lower blood pressure.

CLASSIFICATION OF CARDIOMYOPATHY:

Restrictive Cardiomyopathy - develops when the ventricles become stiff and rigid but the walls of the heart do not thicken. As a result, the ventricles do not relax and don't fill with the normal blood volume. As the disease progresses, the ventricles do not pump as well and the heart muscle weakens. Over time, restrictive cardiomyopathy can lead to heart failure and problems with the heart valves.

Dilated cardiomyopathy (DCM) - develops when the ventricles enlarge and weaken. The condition usually starts in the left ventricle and over time can affect the right ventricle. The weakened chambers of the heart don't pump effectively, causing the heart muscle to work harder. Over time, the heart loses the ability to pump blood effectively. Dilated cardiomyopathy can lead to heart failure, heart valve disease, irregular heart rate, and blood clots in the heart. For people who are on medication, with stable symptoms and who do not have heart failure or arrhythmias, exercise can play an important role in recovery as well as enhanced quality of life. It can help to improve symptoms and is not likely to affect the underlying condition. Exercise prescription will depend on the person's individual symptoms.

Hypertrophic cardiomyopathy (HCM) - happens when the heart muscle enlarges and thickens without an obvious cause. Usually the ventricles, the lower chambers of the heart, and septum (the wall that separates the left and right side of the heart) thicken. The thickened areas create narrowing or blockages in the ventricles, making it harder for the heart to pump blood. Hypertrophic cardiomyopathy also can cause stiffness of the ventricles, changes in the mitral valve, and cellular changes in the heart tissue.

If you detect an arrhythmia during exercise testing, please refer your client to their doctor before any further exercise or testing is done. The individual may be considered for an ICD (implantable cardioverter defibrillator). An ICD uses electrical pulses or shocks to help control life-threatening arrhythmias.

Arrhythmogenic right ventricular dysplasia - is a rare type of cardiomyopathy that occurs when the muscle tissue in the right ventricle is replaced with fatty or fibrous tissue. This can lead to disruptions in the heart's electrical signals and causes arrhythmias. Arrhythmogenic right ventricular dysplasia usually affects teens or young adults and can cause sudden cardiac arrest in young athletes.

UNCLASSIFIED CARDIOMYOPATHY:

Left ventricular noncompaction - occurs when the lower left chamber of the heart, which helps the heart pump blood, does not develop correctly. Instead of the muscle being smooth and firm, the cardiac muscle in the left ventricle is thick and appears spongy. The abnormal cardiac muscle is weak and has an impaired ability to pump blood because it either cannot completely contract or it cannot completely relax.

Takotsubo cardiomyopathy - also known as Takotsubo syndrome, is a temporary condition where your heart muscle becomes suddenly weakened or 'stunned'. The left ventricle, one of the heart's chambers, changes shape and enlarges. Though rare, this condition is more common in post-menopausal women.

** Make sure to obtain proper medical clearance and adhere to doctors' recommendations.*

**Intensive or competitive exercise is not recommended for anyone with cardiomyopathy.*

CHAPTER EIGHT

EXERCISE INTENSITY

Objective: to understand the different stages and side-effects of treatment and how they affect exercise intensity and prescription

- What is client's target heart rate?
- What level of intensity should they be striving for?
- Are they currently experiencing any side-effects of treatment?
- What are the recommended modifications/considerations?
- Under what circumstances should they avoid exercise, or cease exercise?

Goal: to create a safe and effective program using the Karvonen method to calculate target heart rate. Carefully consider any side-effects and contraindications while making exercise recommendations.

EXERCISE INTENSITY

Karvonen Method - takes into account resting HR which is often higher in cancer patients[181]. However, any medication that affects heart rate, for example Beta-blockers, invalidates the formula. For these patients, subjective means of gauging intensity such as rate of perceived exertion (RPE) assessed by BORG Scale can be used. Moderate intensity activity is a level of effort of 12 or below on a 1–20 scale while vigorous intensity is a 14–16 on the same scale [181].

Table 3.0

Borg Rating of Perceive Exertion (RPE) Scale		
6 - 7 - 8 - 9 - 10 - 11 -	Very, very light Very light Fairly light	How you feel when lying in bed or sitting in a chair relaxed. Little or no effort
12 - 13 - 14 - 15 - 16 -	Somewhat hard Hard	Target range: How you should feel with exercise or activity
19 - 18 - 19 - 20 -	Very hard Very, very hard Maximum exertion	How you felt with the hardest work you have ever done. Dont work this hard!

Example of a patient that is 60 years of age with a resting HR of 60.

[Maximum Heart Rate - Resting Heart Rate] x % Intensity)+ Resting Heart Rate

(Maximum Heart Rate) 220 - Age (60) = 160

Subtract Resting HR 160-60 = 100 x 50% (Intensity)

100 x 50% (50) + 60 (Resting HR) = 110

110 is the Target HR.

DESIGNATE LEVELS:

Subtract the patient's age from 220 and take a percentage as their target HR for exercise.

- **Level 1: low intensity,** for lower functioning clients **– 20-40%** of their target HR.
- **Level 2: moderate intensity,** for clients with ongoing chemo or radiation **– 40-60%** of their target HR.
- **Level 3: high intensity,** for clients who have completed medical treatment **– 60-80%** of their target HR.

Heart rate is currently the preferred method to establish exercise intensity, although many researchers have had success using the Borg rating of perceived exertion scale (1–20) [181]. The current exercise guidelines for cancer patients suggest an intensity level of moderate-to-vigorous, which is defined as 40%–60% of maximal oxygen uptake reserve (VO2 reserve) or heart rate reserve (HRR) [181].

Effective aerobic conditioning programs incorporate some type of low level activity, followed by intermittent high intensity exercise in significantly shorter durations. Walking is typically the preferred modality of aerobic activity, but any modality may be considered with thought given to surgery and treatment side-effects and contraindications (i.e., cycling for prostate patients) [181]. Aerobic training sessions are typically prescribed on alternating days throughout the week. This alternating level of high intensity/low intensity allows for significant overload and stimulus for adaptation while proving very safe and effective [181]. In the initial phase of conditioning at low intensity levels, it is not necessary to supervise the exercise sessions but during higher intensity exercise sessions your client may need supervision by a health professional [181].

TABLE 3.1

ABSOLUTE CONTRAINDICATIONS AND RECOMMENDATIONS FOR EXERCISE

CONTRADICTION	RECOMMENDATIONS
External beam radiation or non-intravenous chemotherapy	No exercise within two hours – increased circulation may increase the effects of treatment.
Intravenous chemotherapy	No exercise within 24 hours
Hematocrit < 25%	No exercise
Hemoglobin < 24% 8g/dl – anemic	No exercise
White blood cell count < 500 mm3	No exercise
Platelet count < 5,000 mm3 <30,000 (only gentle active ROM)	No resistance exercise – risk of internal hemorrhage
Survivors with immunosuppressants should avoid public gyms until their white blood cell counts return to safe level (>500/mm3)	Avoid public gyms
Bone marrow transplanted survivors within one year after transplantation	Avoid exposure to public places with risk of microbial contamination.
Adriamycin (chemical name: doxorubicin) is part of chemotherapy regimen	No exercise on the day of chemotherapy and only very low intensity exercise (heart rate is no greater than 15 to 20 beats above resting heart rate) for 24 to 48 hours after infusion. This is because Adriamycin can make the heart beat irregularly for about 24 hours afterward.
PICC line	Avoid resistance exercise of muscle in the area to avoid dislodgement of catheter. Do not swim or play contact sports. Avoid repetitive motions with affected arm.
Fever	No exercising - recommend that client see their doctor to eliminate the possibility of a systemic infection.
Moderate/severe angina, dizziness or pre-syncope, cyanosis or pallor	Discontinue exercise, monitor heart rate, and blood pressure. Have client sit or lie down and give them some water. Notify doctor and arrange patient transportation to hospital E.R.
A drop in systolic blood pressure (10 mm. Hg. from baseline despite increases in workload, when accompanied by other indications of ischemia)	Stop exercise
Moderate to severe angina	Stop exercise
Increasing nervous system symptoms (i.e. ataxia, dizziness or near syncope) Signs of poor perfusion (cyanosis or pallor)	Stop exercise
Client's desire to stop	Stop exercise

TABLE 3.2

COMMON SIDE-EFFECTS, COMPLICATIONS, AND RECOMMENDATIONS FOR EXERCISE

SIDE-EFFECT/COMPLICATION	RECOMMENDATIONS
Blood glucose	<100 or >250 Wait to exercise until blood glucose levels are in normal range.
Dehydration (vomiting/diarrhea within 24-36 hours)	No exercising for 24-26 hours. The exception would be early or late dumping syndrome; if client has chronic vomiting or diarrhea. In this case, replenish electrolytes, rehydrate, and have them work at low intensity.
Nausea	Exercise at a level client can tolerate.
Fatigue	Exercise at a level client can tolerate preferably 20-30 minutes 3-4 times per week.
Bone/joint pain	Avoid high-impact activities, or those with a risk of falling (prevent fracture). Have client follow-up with doctor to eliminate the possibility of metastasis.
Bone metastases (including lytic myelomatous lesions) – pelvis & proximal femur	Caution regarding hip hyperflexion and hyperextension and high torque or rotational movements.
Bone metastases (including lytic myelomatous lesions) – spine	Caution regarding axial loading. Avoid lumbar hyperflexion and hyperextension and high torque rotational movements.
Bone metastases (including lytic myelomatous lesions) – ribs	Caution regarding high torque or rotational movements through torso.
Bone metastases (including lytic myelomatous lesions) – shoulder	Caution regarding extreme shoulder flexion, extension, abduction, and adduction.
Bone metastases (including lytic myelomatous lesions) – appendicular skeleton	Modify or avoid for localized signs and symptoms.
Severe weight loss (greater than 35% of their weight)	Low intensity exercise due to loss of muscle mass. Strength training will be beneficial in increasing lean muscle mass.
Peripheral neuropathy	If it is in the feet, avoid high-impact activities as well as those that require balance and coordination. If it is in the hands, use machines rather than hand weights. Modify activities that require balance to reduce risk of falling.
Dizziness	Avoid activities that require balance and coordination.
Increasing chest pain, fatigue, shortness of breath, wheezing, or claudication	Reduce exercise intensity or facilitate active recovery (monitor heart rate & blood pressure).
"Pitting" edema or awareness of "heaviness", "warmth", or increase in baseline girth measurements in area at risk for lymphedema	Have client see doctor ASAP to evaluate for lymphedema.

CANCER PATIENTS SHOULD CONTACT THEIR PHYSICIAN IF ANY OF THE FOLLOWING ABNORMAL RESPONSES DEVELOP:

- Fever
- Extreme or unusual tiredness or unusual muscular weakness
- Irregular heartbeat, palpitations, or chest pain
- Leg pain or cramps, unusual joint pain, unusual bruising or nosebleeds
- Sudden onset of nausea during exercise
- Rapid weight loss, severe diarrhea or vomiting
- Disorientation, confusion, dizziness, lightheadedness, blurred vision, or fainting
- Pallor or gray-colored appearance
- Night pain, or pain not associated with an injury

CHAPTER NINE
CORRECTING RANGE OF MOTION LIMITATIONS

Objective: to understand how to use a goniometer to determine joint ROM and to choose the proper stretches/ strengthening exercises to help achieve the desired results.

- What are the three parts of a goniometer?
- What are the planes of the body and what joint motion occurs in each?
- What are the "norms" for the five planes of motion?
- Is the ROM limitation a strength or flexibility issue?
- What are the recommended modifications/considerations?

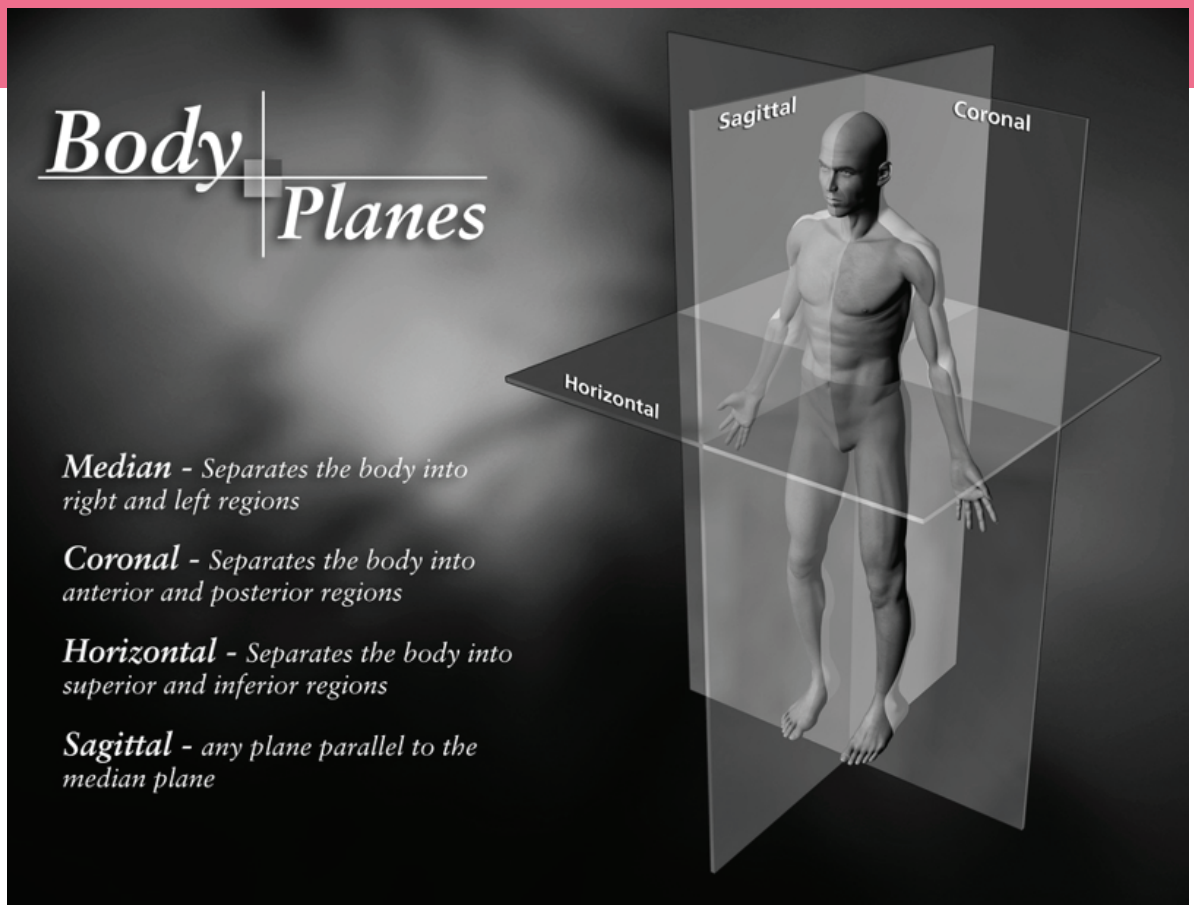
Goal: to determine whether ROM limitations are caused by scar tissue or hypertonic/hypertrophic muscles and to choose appropriate exercises that will help increase ROM and improve their ability to perform ADL's.

CORRECTING RANGE OF MOTION LIMITATIONS

Following breast surgery/reconstruction shoulder range of motion limitations (ROM) are not uncommon. It is important to address these issues because they can lead to additional joint deterioration, and/or frozen shoulder, if not corrected. Conducting a ROM assessment with a goniometer will help determine which areas need attention. Before beginning a resistance training program, your client should have 90% or better of the lower end of the ROM norm. Remember that ROM measurements taken passively are ***typically*** a reflection of flexibility while measurements taken actively are ***typically*** a reflection of strength. This process is described in detail and norms for each plane of motion are listed in the shoulder ROM section of this book.

For example, if norms for flexion are 150-180, your client should be at no less than 135 degrees of passive ROM before they do any resistance training in flexion. If they are limited in passive ROM, it is likely that they will be limited in active ROM as well. It is a good idea to begin by taking the passive ROM measurements; as the results will dictate the next step. If they are limited in passive ROM, there isn't much need to take the active ROM measurement (other than for baseline purposes), as their focus will need to be on flexibility and ROM before they begin strength training. Flexibility limitations ***always*** outweigh strength limitations. You ***do not*** want a client to become stronger in a limited plane of motion.

Clients may begin resistance training in other planes of motion if they are 90% or better of the normal range in that plane. Therefore your client who only has 125 degrees of shoulder ROM in flexion, should not do a pullover, or other "shoulder flexion" exercise, with any type of resistance. They can, however, do exercises with resistance in the other planes of motion. It is important for you to consider which exercises take place in any given plane of motion. You can use this determination to make recommendations based on the need for improved flexibility or strength. Below you will find some examples of exercises to help correct ROM limitations for strength and flexibility. You can use any exercise you would like - with strength vs. flexibility in mind. They can be conventional strength training, Yoga, Pilates, water-based, etc. Keep in mind that these corrective exercises apply to ***anyone*** (not just breast cancer clients) who has a specific ROM deficiency. **The body and planes chart below** will help you to understand the planes of the human body, as well as which motions take place in each plane (axis). **Table 4.1** will give you ideas of sample strength training exercises in each plane.



PLANES OF MOTION

There are three dimensions that all human movement occurs in. It is typically referred to in planes and axes. Three imaginary planes are positioned through the body; all intersecting at the body's center of mass. These planes are termed ***Median (Sagittal), Coronal (Frontal),*** and ***Horizontal (Transverse)***. If a movement occurs parallel to that plane, it is thought to occur predominantly in that plane. While this holds true to a certain extent, ***NO*** motion occurs strictly in one plane. Joint motion is the movement in a plane that occurs around an axis that runs perpendicular to that plane.

- **The Median (Sagittal) Plane -** this plane bisects the body into the right and left sides. Joint motion in this plane occurs around a frontal axis and includes ***flexion and extension.*** Flexion is the decrease in joint angle and extension is the increase in joint angle. Flexion and extension occur in many of the joints in the body, however they are referred to as ***plantarflexion*** and ***dorsiflexion*** when referring to the ankle.

- **The Coronal (Frontal) Plane -** this plane bisects the body into its front and back halves. Joint motion in this plane occurs around an anterior/posterior axis and includes ***abduction*** and ***adduction*** of the limbs, ***lateral flexion*** of the spine, and ***eversion and inversion*** of the foot. Abduction means to move away from the midline of the body, or increasing the joint angle. Adduction means movement toward the midline of the body, or decreasing the joint angle. Lateral flexion may refer to bending any part of the spine (cervical, thoracic, or lumbar) from side to side. Eversion and inversion refer to movement at the foot and ankle complex during pronation and supination.

- **The Horizontal (Transverse) Plane -** this plane bisects the body into top and bottom halves. Joint motion in this plane occurs around a longitudinal or vertical axis and includes ***internal and external rotation*** of the limbs, ***right and left rotation*** for the head and trunk, and radioulnar ***pronation and supination.*** When referring to transverse plane motions of the foot, we use the terms abduction and adduction. Abduction is when the toes are ***externally rotated*** (pointing outward) and adduction is when the toes are ***internally rotated*** (pointing inward).

TABLE 4.1 - PLANES, JOINT MOTIONS, AND SAMPLE STRENGTHENING EXERCISES

Plane	Joint Motion	Sample Strengthening Exercises
Median (Sagittal)	Flexion and Extension	Bicep Curls Tricep Pushdowns Tricep Kickbacks Pullover Frontal Shoulder Raises Lunges Squats Chair Pose (Yoga) Eagle Pose (Yoga) High Lunge (Yoga) Magic Circle at the Back (Pilates) Magic Circle Overhead (Pilates) Back Rowing (Pilates)
Coronal (Frontal)	Adduction and Abduction Lateral Flexion Eversion and Inversion	Snow Angel Lateral Shoulder Raises Side Lunges Side-stepping with Band Triangle Pose (Yoga) Warrior II Pose (Yoga) Mountain Pose (Yoga) Saw (Pilates) Small Arm Circles (Pilates) Side Arm Series (Pilates)
Horizontal (Transverse)	Internal and External Rotation Left and Right Spinal Rotation Horizontal Adduction and Abduction	Cable rotation Dumbbell rotation Cow Face Pose (Yoga) Half Lord of the Fishes Pose (Yoga) Band at Side ER/IR (Pilates) Back Rowing 45 Degrees (Pilates)

RANGE OF MOTION ASSESSMENT PROTOCOL

Purpose: To determine the range of motion and measure the flexibility of a specific joint

Equipment: Goniometer

GONIOMETRIC MEASUREMENTS

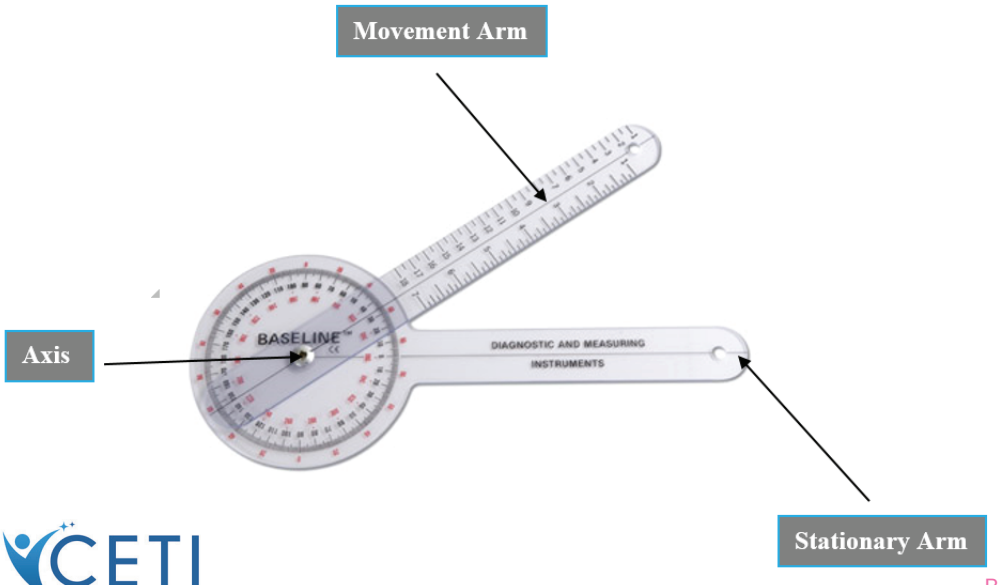
A goniometer is a device that is typically used by physical and occupational therapists to measure the range of motion around a joint. The word goniometer is derived from the Greek terms gonia and metron, which mean angle and measure, respectively. Goniometers can help the examiner to determine whether the restriction at a particular joint is primarily a function of strength (or lack of) or flexibility (or lack of - possibly from scar tissue). Measurements may be taken actively (when the client or patient moves the selected joint(s) through full ROM without any assistance from the examiner), or passively (where the examiner moves the joint(s) through full ROM without any assistance from the client/patient). A goniometer is usually made of transparent plastic. There are some goniometers that are made of metal. There are two "arms" of the goniometer: the stationary arm and the moveable arm. Each arm is positioned at specific points on the body and the center of the goniometer (axis of rotation) is aligned at the joint to be measured.

When first meeting with a client/patient, you should use a goniometer to obtain a baseline range of motion around a specific joint. These measurements can be compared to normative ROM data for each joint, thus helping to determine what the goal(s) of a particular exercise will be. Typically, measurements are taken again after 8-12 weeks to look for tangible signs of improvement.

PROCEDURES:

1. HOW TO USE A GONIOMETER

- Identify stationary arm
- Identify movement arm
- How to read the angle



2) IDENTIFY FLEXIBILITY VS. STRENGTH

- **Flexibility –** for the purposes of our testing, this will refer to the amount of motion that is obtained while client is in supine position. This is not to say that these measurements are not affected at all by muscular strength (or lack thereof), however, they are a fairly accurate reflection of the client's limitations from scar tissue and adhesions vs. actual muscular strength.

- **Strength –** for the purposes of our testing, this will refer to the amount of motion that is obtained while client is in upright standing or sitting position (when unable to stand).

- Begin by taking supine measurements on both sides. Note the difference between the affected side (side with surgery or radiation) and the unaffected side.

- If ROM in the supine position is not 90% of the lowest end or the norms (ie; 150˚ - 180˚ the client needs to have at least 135˚) before adding any resistance in that particular plane of motion, the focus will need to be on improving ROM through stretching and flexibility exercises before you even consider adding a load to any movement. To place an additional load on the muscles would strengthen them in that limited ROM and hinder their improvement.

1) Stationary arm - in line with body

   Axis - at shoulder joint

   Movement arm - in line with elbow/shaft of humerus

2) Have client in the supine position, with knees bent to flatten the lumbar spine. Arm should be extended at the side of the body **(Figure 1A).** This is the starting position. The arm is then raised forward and up overhead **(Figure 1B).** Palm will face in toward the body with thumb pointing upward and will end with palm still facing in, but thumb pointing down or backward.

   Make sure to have client stabilize the scapula to prevent upward rotation and elevation of the scapula. If you notice excessive movement in their scapula, or see their lower back arch, have them back off a few degrees to the point where the compensation is no longer obvious.

SHOULDER MOTION

Figure 1A

Figure 1B

B. Abduction - ROM Norms: 150˚- 180˚

Figure 2A

Figure 2B

1) Stationary arm - in line with body

   Axis - at armpit

   Movement arm - in line with elbow/shaft of humerus

2) Have client in the supine position, with knees bent to flatten the lumbar spine. Arm should be extended at the side of the body with palm facing upward **(Figure 2A)**. The arm is moved laterally away from the client's trunk, moving toward the head **(Figure 2B).** The palm stays facing upward throughout the motion.

   Make sure that the client does not rotate their arm (watch the elbow) and that their humerus does not come off of the table or floor when taking measurement. If either of those things are noted, have the client back off a few degrees to the point where the compensation is no longer obvious.

C. Extension - ROM Norms: 40˚- 60˚

Figure 3A

Figure 3B

1) Stationary arm - in line with body

   Axis - at shoulder joint

   Movement arm - in line with elbow/shaft of humerus

2) Have client lie on their side, making sure that their spine is in a straight line and their head is supported with a pillow **(Figure 3A).** This may be a more comfortable option for someone who has recently undergone surgery, or is otherwise uncomfortable in prone position. Keeping their arm level, and parallel to the table, have them extend it behind the midline of their body **(Figure 3B).** Make sure that their spine remains in a straight line.

   Make sure to have client stabilize the scapula to prevent anterior tilting of the lumbar spine and elevation of the trapezius. If you notice excessive movement in their trapezius, or see their back arch, have them back off a few degrees to the point where the compensation is no longer obvious.

D. External Rotation - ROM Norms: 70˚- 90˚

Figure 4A

Figure 4B

1) Stationary arm - perpendicular to table or floor

   Axis - elbow joint (if taken while lying on the floor, the bottom of the stationary arm will be resting on the floor and axis of rotation will be slightly above the elbow.

   Movement arm - along shaft of ulna (forearm)

2) Have client in the supine position, with knees bent to flatten the lumbar spine. Have them bend their elbow to 90 degrees (at the shoulder joint). Their forearm should be perpendicular to the table, with their palm facing away from them (towards feet) and their fingers pointing straight up to the ceiling **(Figure 4A).** It is helpful to place a very small rolled up towel under their elbow to keep the upper arm level, and keep the elbow from dipping below the shoulder. The humerus should be supported by the table, and the elbow will be unsupported (the elbow will be supported if taking the measurement on the floor). Have them rotate their forearm backward toward floor **(Figure 4B).** At the beginning of the motion, stabilize the elbow joint in order to maintain 90˚.

   Make sure to have client stabilize the scapula to prevent upward rotation and elevation of the scapula. If you notice excessive movement in their scapula, or see their lower back arch, have them back off a few degrees to the point where the compensation is no longer obvious.

E. Internal Rotation - ROM Norms: 40˚- 60˚

Figure 5A

Figure 5B

1) Stationary arm - perpendicular to table or floor

   Axis - elbow joint

   Movement arm - along shaft of ulna (forearm)

2) Have client in the supine position, with knees bent to flatten the lumbar spine. Have them bend their elbow to 90 degrees (at shoulder joint). Their forearm should be perpendicular to the table, with their palm facing away from them (towards feet) and their fingers pointing straight up to the ceiling **(Figure 5A).** It is helpful to place a very small rolled up towel under their elbow to keep the upper arm level, and keep the elbow from dipping below the shoulder. The humerus should be supported by the table, and the elbow will be unsupported (the elbow will be supported if taking the measurement on the floor). Have client rotate their arm forward **(Figure 5B).** Toward the end of the motion, use your hand to stabilize the clavicle and acromium process to prevent anterior tilting and protraction of the shoulder (you should be gently placing your hand on the AC joint and stopping their movement as soon as you feel a contraction beneath your fingertips).

   Make sure to have client stabilize the scapula to prevent anterior tilting of the lumbar spine. If you notice excessive movement in their clavicle/acromium process, or see their back arch, have them back off a few degrees to the point where the compensation is no longer obvious.

F. Hip Flexion - ROM Norms: 100˚- 120˚

Figure 6A

Figure 6B

1) Stationary arm - in line with the midline of the body

   Axis - lateral aspect of the hip joint

   Movement arm - in line with the lateral midline of the femur

2) Have client in the supine position with both legs fully extended **(Figure 6A).** Flex the hip by lifting the thigh off of the table **(Figure 6B).** Simultaneously flex the knee. Gently move leg toward the chest. Keep the lower back flat on the table in neutral position and stabilize the pelvis with one hand to prevent posterior tilting. If you see their back arch, have them back off a few degrees to the point where the compensation is no longer obvious.

G. Hip Extension - ROM Norms: 20˚- 30˚

Figure 7A

Figure 7B

1) Stationary arm - in line with the midline of the body

   Axis - lateral aspect of the hip joint

   Movement arm - in line with the lateral midline of the femur

2) Have client lie in the prone position with both legs fully extended and head turned to the side, or face down with a small towel rolled up under the forehead **(Figure 7A).** Extend the hip by lifting the thigh off of the table **(Figure 7B).** Make sure that the knee is extended (not locked) throughout the entire motion. Keep the opposing leg flat on the table and hold the pelvis with hand to prevent anterior tilting. If you see their back arch excessively, have them back off a few degrees to the point where the compensation is no longer obvious.

H. Hip Abduction - ROM Norms: 40˚- 42˚

Figure 8A

Figure 8B

1) Stationary arm - in line with and imaginary horizontal line extending across the front of the body at the level of both anterior superior iliac spines.

   Axis - over the anterior superior iliac spine (ASIS) of the leg being measured

   Movement arm - in line with the anterior midline of the femur

2) Have client in the supine position with both legs fully extended **(Figure 8A).** Move the leg being tested laterally while keeping the opposing leg stationary **(Figure 8B).** Do not allow any rotation of the hip. Keep your hand on the pelvis at the ASIS to prevent lateral tilting, rotation, and/or lateral trunk flexion.

I. Hip Adduction - ROM Norms: 20˚- 22˚

Figure 9A

Figure 9B

1) Stationary arm - in line with and imaginary horizontal line extending across the front of the body at the level of both anterior superior iliac spines.

   Axis - over the anterior superior iliac spine (ASIS) of the leg being tested

   Movement arm - in line with the anterior midline of the femur

2) Have client in the supine position with both legs fully extended. Abduct the opposing leg to allow for adequate movement of the leg being tested **(Figure 9A).** By placing one hand on the knee, slide the leg being tested medially toward the opposite leg. Keep one hand on the pelvis at the ASIS to keep the hip in neutral **(Figure 9B).**

J. Knee Flexion - ROM Norms: 142˚- 150˚

Figure 10A

Figure 10B

1) Stationary arm - in line with the lateral midline of the femur

   Axis - over the lateral epicondyle of the femur

   Movement arm - in line with the lateral midline of the fibula

2) Have client in the supine position with both legs fully extended **(Figure 10A)**. Do not allow any rotation, abduction, or adduction of the hip. Keep your hand on your client's ankle or shin while placing their thigh at approximately 90 degrees of hip flexion. Move the knee into flexion **(Figure 10B).**

K. Knee Extension - ROM Norms: 0˚- 10˚

Figure 11A

1) Stationary arm - in line with the lateral midline of the femur

   Axis - over the lateral epicondyle of the femur

   Movement arm - in line with the lateral midline of the fibula

2) Knee extension is usually recorded as the starting position for flexion. Limited extension is present when the starting position does not begin at 0 degrees, but in some amount of flexion. Have client in the supine position with both legs fully extended. Extend the knee of the leg being tested and make sure that the hips are in neutral **(Figure 11A).**

STRETCHES FOR IMPROVING RANGE OF MOTION

The following stretches may be recommended for anyone wanting to improve shoulder flexion:

Seated Shoulder Flexion

- Instruct client to sit upright in a chair, about arms distance from the table
- Have them slowly begin to slide their hand/arm forward on table either with palm down or on the side of the hand (pinky down)
- Advise them to go to the point of mild discomfort and then back off just enough to eliminate any pain
- Have them hold the stretch for 30 seconds and try and reach further with exhalation

Supine Shoulder Flexion

- Instruct client to lie on their back with their knees bent, holding a dowel between their thumbs and forefingers
- Have them slowly raise their arms up overhead, keeping a slight bend in their elbows (make sure that they stay in plane of motion and don't allow their arms to go into abduction)
- Advise them to go to the point of mild discomfort and then back off just enough to eliminate any pain
- Have them hold the stretch for 3-5 seconds, return to start and repeat several times. They can also hold the stretch for 30 seconds as an option

Supine Shoulder Flexion with Alternating Knees

- Instruct client to lie on their back, bend their knees to 90 degrees, and place their arms by their sides with palms facing their body
- Instruct them to raise one arm up into flexion, and raise the opposite leg off of the floor about 6 inches
- Make sure that they keep the movement fluid and alternate sides

Standing Arm Extension with Dowel

- Instruct client to stand erect with their knees soft and a neutral pelvis
- Have them hold a dowel between their thumbs and forefingers with their palms facing their body
- Advise them to raise their arms into extension without arching their back or elevating their trapezius
- Instruct them to pause when they can't go any higher without compromising their form
- Have them slowly lower their arms back to start and repeat

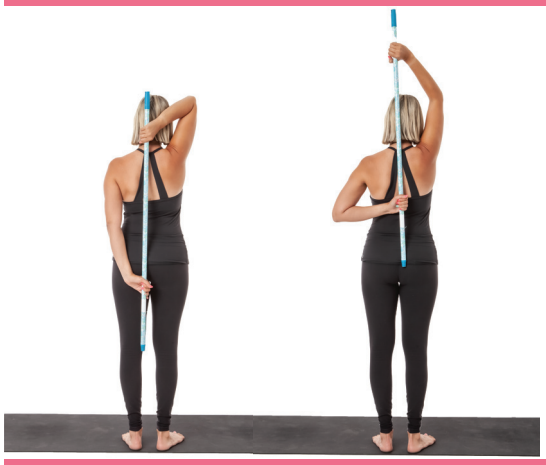
Standing Abduction

- Instruct client to stand erect with their knees soft and a neutral pelvis
- Have them hold a dowel with their hands spread about 30" apart - (R) hand palm faces body and (L) hand palm faces away from body
- Advise them to push gently with their (R) arm upward in abduction; not allowing their (L) shoulder to protract
- Instruct them to pause when they can't go any higher without compromising their form and/or feeling any discomfort
- Have them slowly lower their arms back to start and repeat on other side

Seated Shoulder Abduction

- Instruct client to sit upright in a chair, about arms' distance from the table
- Have them slowly begin to slide hand/arm to the side on table with palm forward on the side of the hand (pinky down)
- Advise them to go to the point of mild discomfort and then back off just enough to eliminate any pain
- Instruct them to hold the stretch for 30 seconds and try and reach further with exhalation

Standing Internal/External Rotation with Dowel



- Instruct client to stand erect with their knees soft and a neutral pelvis
- Have them hold a dowel between their thumbs and forefingers (one shoulder should be internally, and one externally rotated)
- They should allow externally rotated shoulder to slightly lift up on dowel, creating a greater stretch to the internally rotated shoulder
- Advise them to pause when they get to the point of mild discomfort
- Instruct them to slowly lower their arms back to start and allow internally rotated arm to slightly pull down on dowel, creating a greater stretch to the externally rotated shoulder

Standing Internal/External Rotation with Dowel

- Instruct client to stand erect with their knees soft and a neutral pelvis
- Have them hold a dowel overhead with their arms bent at 90 degrees
- Instruct them to rotate their shoulders backward into external rotation (keeping their pelvis in neutral)
- Advise them to pause when they can't rotate any further without compromising their form
- Have them slowly lower their arms down into internal rotation (do not allow excessive protraction of shoulder)

Supine Internal/External Rotation

- Instruct client to lie on their back with their knees bent and arms out to their side at 90 degrees with their palms toward their knees
- Have them rotate their shoulders backward into external rotation (keep pelvis in neutral)
- Advise them to pause when they can't rotate any further without compromising their form
- Have them slowly lower their arms down into internal rotation (do not allow posterior shoulder to come off of floor, or excessive protraction of shoulder)

CHAPTER TEN

OTHER CONCERNS

DEHYDRATION

Cancer treatment can increase the amount of fluid a person needs to flush the bladder and kidneys. Signs of dehydration include weakness, dizziness, decreased urination, thirst, headache, and possible fever. These symptoms can occur quickly if you lose fluid due to diarrhea, vomiting, or fever. An intake of 48-64 ounces (6-8 eight ounce glasses) of fluid per day is recommended. These fluids should be non-alcoholic and caffeine free since both substances tend to increase fluid loss. Remember, "fluid" does not just mean water.

Broth, juice, fruit drinks, Jell-O, water ice, milk, Ensure, and decaf teas all count as fluid. However, in most cases it's almost impossible for an individual to take enough fluids to make up for the fluid loss that occurs with the diarrhea. That's one of the reasons it's such an important medical problem and why patients end up in the hospital receiving intravenous fluids. If unchecked, severe dehydration, loss of potassium, and in the extreme even death, can occur if this is not appropriately addressed. It is important to **not exercise** within 24-36 hours of vomiting or diarrhea to allow ample time to re-hydrate

LOW BLOOD COUNTS/IMMUNOCOMPROMIZATION

The primary cause of low white blood cell counts (neutropenia) is chemotherapy, radiation, and bone marrow & stem cell transplants. Because chemotherapy cannot differentiate between cancer cells and normal cells, healthy cells are also killed, including white blood cells which work to protect us from infection. When these white blood cells are destroyed, patients become vulnerable to infection. Proper hygiene at this time is critical because even a minor case of the flu can become life-threatening. Client should avoid going to places where there will be a lot of people; gym, movie theater, grocery store, and definitely avoid airplanes! If they have to be around other people, they should not share towels or drinking glasses, they should wash their hands regularly, and avoid kissing anyone who is sick. The risk of lowered blood cell counts varies according to the type of cancer, dosage, and schedule of treatment you receive. There is a higher risk if someone is 70 years or older, have an already compromised immune system, and/or have had previous chemotherapy or radiation.

Some of the symptoms to look for are:

- **Fever greater than 100.4°**
- **Chills/sweating**
- **Sore throat or cough**
- **Mouth ulcers**
- **Diarrhea or burning sensation during urination**
- **Redness, pain, or swelling around a wound or sore**

During treatment their doctor will be closely monitoring their white blood cell count as well as other indicators for signs of a compromised immune system. Their white blood cell count will typically reach its lowest point 10-14 days after chemotherapy.

FATIGUE

Chemotherapy can lower the number of red cells in their blood, which carry oxygen throughout the body and give them energy. Fatigue can also result from surgery and radiation oncology. Cancer and cancer treatment can also disrupt your client's eating or sleeping habits, both of which may result in fatigue. Fatigue in people with cancer may have other causes. Tumors can cause fatigue directly or indirectly by forming toxic substances in the body that interfere with normal cell functions.

Medication, lack of exercise, or pre-existing physical or psychological conditions can cause fatigue. Fatigue is a common symptom associated with chemotherapy, radiation, surgery, and anemia. Fatigue from chemotherapy affects most patients, lasting for one to two weeks following treatment, than decreasing gradually. Chemotherapy can lower the number of red cells in the bloodstream, which carry oxygen throughout the body and give you energy. Having fewer red blood cells means that your body gets "out of breath" when you do something even mildly strenuous. Fatigue as a result of radiation oncology affects almost all patients and may worsen during the course of your treatment, peaking at four to six weeks. In order to heal itself, the body uses a lot of energy during radiation oncology. The additive effects of stress related to your illness, daily trips for treatment, and the effects of radiation on normal cells all may contribute to fatigue. Fatigue usually lessens after your therapy is completed, although not all patients return to their normal levels of energy.

Fatigue is a problem following surgery, but fatigue from surgery improves with time. It can be worse, however, when it is combined with the fatigue caused by other cancer treatments. Fatigue from cancer surgery can last for weeks or months, and may be caused by anxiety from surgical preparation and pre-surgical testing. Pain after surgery, the effects of anesthesia, sedatives, or analgesics may also cause fatigue. Anemia is a major factor in cancer-related fatigue and quality of life in people with cancer. It may be caused by the cancer itself or by cancer treatments, or it may be related to other physiological changes.

It is a feeling of severe tiredness and is experienced by people who have surgery, radiation, chemotherapy and, other forms of cancer treatment. Fatigue is the most common side-effect of cancer treatment and is reported by approximately 76% of all patients. Fatigue related to cancer treatment is different from everyday fatigue. It can appear suddenly and be overwhelming. It is not always relieved by rest and can last after treatment ends. Cancer treatment-related fatigue can affect many aspects of one's life, but there are some practical measures that may help to relieve fatigue. Different people experience different symptoms.

People with cancer treatment-related fatigue describe feeling weak, sleepy, drowsy, weary, confused or impatient. It is probably due to a range of problems related to your cancer and your cancer treatment, including having a low blood count, sleep disruption, feeling stressed and not eating properly.

- **Fatigue can affect how someone thinks as well as how they feel**
- **They may need more sleep**
- **They may experience physical, emotional and/or mental exhaustion**
- **Their body, especially your arms and legs, may feel heavy**
- **They may have less desire to do normal activities like eating or shopping**
- **They may find it hard to concentrate or think clearly**
- **It may affect their ability to perform activities of daily living; shower, shave, brush teeth, etc.**
- **It may affect their quality of life**

Moderate exercise has been found to relieve fatigue symptoms in both healthy people and those with cancer. Light to moderate exercise can gently energize your client and increase their daily function. The type of exercise we're talking about differs from casual, everyday activity, in that an exercise program is a controlled activity used to maintain energy and minimize fatigue. An exercise program should be tailored to the individual according to age, gender, and physical and medical conditions. Exercises should involve rhythmic and repetitive movement of large muscle groups (such as walking, cycling, or swimming). These exercises should begin gradually, several days a week, and should not be performed to the point of exhaustion. There are some negative aspects to low-intensity exercise, including cardiac abnormalities, recurrent or unexplained pain, and the onset of nausea. If you client experiences any of the previously mentioned symptoms, have them stop exercising and consult their physician immediately.

BLISTERS/BURNS

A common side effect of radiation therapy is skin irritation in the area of the body that is being treated. The skin reaction can range from mild redness and dryness, similar to a sunburn, to severe peeling of the skin in some patients. The majority of skin reactions to radiation therapy go away a few weeks after treatment is completed. In some cases, the treated skin will remain slightly darker than it was before and it may continue to be more sensitive to sun exposure. It is important to notify your physician when your skin becomes irritated because redness and dryness can eventually progress to peeling with oozing of fluid in the area. Radiation can have a detrimental effect on your lymphatic system, making you more prone to lymphedema. An open wound is a perfect medium for bacteria and can lead to an infection which may in turn lead to lymphedema. Your client's doctor or nurse can suggest measures to relieve their discomfort and possibly minimize further irritation as well as risk of lymphedema. There are effective topical medications for treatment of radiation induced skin irritation, as well as a number of precautions that may minimize skin irritation during radiation therapy, such as:

- **They should check with their nurse or physician regarding the use of creams or lotions**
- **Keep the treated area dry and free from irritation**
- **Wash the skin in the treatment area only with mild soaps**
- **Use a mild shampoo, such as baby shampoo, if the head is being treated**
- **When using a towel, pat the area dry instead of rubbing**

- **If they must shave in the treated area, use an electric razor to prevent cuts**
- **Avoid using shaving lotions or scented creams**
- **Do not use perfumes, deodorants, or makeup in the treated area**
- **Avoid using heating pads or ice packs on the skin in the treated area**
- **Wear loose-fitting clothing that does not rub on the skin in the treated area**
- **Avoid harsh fabrics over the treatment area, such as wool, corduroy, or starched cloth**
- **Unless necessary, do not use adhesive tape, including band aids and paper tape on the treated area**
- **Do not swim in salt water, lakes, pools, or ponds**
- **Do not swim in swimming pools**
- **Always report any discomforts or concerns to your nurse or doctor**
- **Avoid sun exposure in the treated area**

CANCER-RELATED PAIN

Not all people with cancer experience pain and not all cancers produce pain equally. Some cancers, even when advanced, may not produce pain at all. Cancers involving bone, either directly or through the spread of the disease are usually associated with pain when advanced. Pain can have a terrible effect on one's quality of life and ability to function. It can lead to depression, irritability, and withdrawal from social activity, anger, loss of sleep, loss of appetite, and an inability to cope. Pain may be acute or chronic. Acute pain is severe and lasts a relatively short time. It is usually a signal that the body is being injured in some way, and the pain generally disappears when the injury heals. Chronic or persistent pain may range from mild to severe, and it is present to some degree for long periods of time. Some people with chronic pain that is controlled by medicine can have breakthrough pain. This occurs when moderate to severe pain "breaks through" or is felt for a short time. It may occur several times a day, even when the proper dose of medicine is given for chronic or persistent pain. Fortunately, pain can usually be controlled. Doctors, nurses, and all other members of the health care team are concerned with treating and controlling pain. Ongoing assessment of the types of pain that develop and change during the course of the cancer and its' treatment are essential to prescribing appropriate pain treatments. If pain is present, it can be caused by several factors, including those that have nothing to do with cancer.

It is imperative that the cancer patient alerts the doctor immediately about any pain that they have. If cancer pain is left unattended, it can affect the patient's ability to work and participate in normal activities, as well as their quality of life. Not all people will be able to tolerate their drug treatment. Some people are allergic to certain medications. Some will eventually develop side effects from the medications. Some will tolerate one specific drug in a class of drugs, but not tolerate others in the same class. Some people may not be able to tolerate any of the drugs within a particular class. World Health Organization guidelines suggest that doctors try a particular drug in its class to see if the patient will indeed tolerate it. The dosage is then increased until the patient gets either pain relief or intolerable side effects. Before abandoning that class of drugs entirely, another drug in that class will be tried. Sometimes the side effects can be managed with other treatments before discontinuing therapy.

If your client is currently taking narcotics for pain, it is not advisable to exercise while under the influence of such drugs. Side effects of such drugs include dizziness, light-headedness, blurred vision, and nausea. It would be inadvisable to participate in any type of exercise under such circumstances.

Some alternate methods of pain control include the following:

- **Exercise**
- **Relaxation / meditation**
- **Imagery / visualization**
- **Hypnosis**
- **Transcutaneous nerve stimulation**
- **Acupuncture / acupressure**
- **Massage**
- **Talking with clergy or other spiritual advisors**
- **Music**

EARLY MENOPAUSE

Following chemotherapy and hormonal therapy, the majority of women will experience the early onset of menopause. In women under forty, there is a chance that it will reverse itself. The closer a women is to peri-menopause, the less likely it will be to reverse itself.

Menopausal symptoms include the following:

- **Hot flashes**
- **Mood swings**
- **Depression**
- **Sleep disturbances**
- **Vaginal dryness**
- **Decreased libido**
- **Weight gain**
- **Infertility**
- **Increased risk of Osteoporosis**

Unfortunately, they may just have to deal with the miserable hot flashes; keep a hefty supply of ice in the freezer. However, exercise may have a favorable effect on depression and mood swings. Exercise may also help them to sleep better which in and of itself should make them a happier person. It's hard to feel sexy when you are bald, barfing, and having performance issues. Exercise will help them to look and feel better and to improve self-esteem and self-confidence.

WEIGHT GAIN, LYMPHEDEMA, AND STRESS ON THE HEART AND LUNGS

Weight gain is an area of concern for several reasons. First of all, if your client is at risk for lymphedema because they have had lymph nodes removed or irradiated, the excess weight can increase their risk. Adipose tissue (fat) retains fluid and blocks the lymphatic pathways. Secondly, following chemotherapy, you are at risk for Diabetes. Being overweight can increase their risk for Diabetes as well. Lastly, the higher their level of body fat, the harder the heart has to work to pump blood. When the heart is overworked, they run the risk of a heart disease and the heart/lungs may already be weakened from treatment as well. Those are just a few of the many compelling reasons to maintain ideal body weight.

CHAPTER ELEVEN
CONQUERING CANCER WITH NUTRITION

Objective: to gain an understanding of lifestyle choices that affect daily health and long-term risk of developing cancer and other diseases, and:

- Importance of "cooking hygiene" for immunocompromised clients
- Primary nutrition goals for someone living with cancer
- Choosing nutrient-dense and cancer-fighting foods
- Reducing pesticide exposure
- Detoxification with foods and spices

Goal: to be able to provide your clients with GENERAL nutrition and guidelines after they have COMPLETED cancer treatment. There are many contraindications to cancer treatment with certain foods and spices and it is ESSENTIAL that clients who are undergoing treatment seek the advice of a registered dietitian who specializes in oncology.

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There's no longer a question that a good diet is essential for optimal health. We know that the foods we eat, and our lifestyle affect our health. Food, nutrition and physical activity are crucial to our general health and well-being. The same way that our lifestyle choices affect our daily health, it also affects our long-term risk of developing diseases such as cancer. There have been scores of scientific research validating the association of poor dietary choices and the onset of degenerative diseases including cancer. As a matter of fact, according to The American Institute for Cancer Research, it is estimated that between 60 and 70 percent of all cancers have been directly linked to our daily dietary and lifestyle habits. On the other side of the coin, according to the Institute, we can achieve dramatic reductions in our cancer risk by making small adjustments to our daily dietary choices. A significant body of evidence has demonstrated that certain foods, for example, can offer benefits to people already afflicted with cancer either because they help to treat the condition, bolster immune response or because they can potentiate the effectiveness of other conventional or integrative therapies.

Because certain types of cancer treatments can cause immunocompromization, and make people susceptible to infection, food handling and safety is a legitimate concern. All cooking surfaces and utensils should be thoroughly cleaned; this includes sponges that come in contact with raw meat and raw eggs. Eggs and meat should be cooked thoroughly, and all foods should be promptly stored in the refrigerator to minimize bacterial growth. When eating at a restaurant during treatment, avoid foods that are likely to be contaminated with bacteria; undercooked meats, salad bar items, and sushi.

WEIGHT GAIN AFTER A CANCER DIAGNOSIS

In cancer survivors, weight gain may lead to the development of other diseases as well as lower cancer-related survival and overall survival. Additionally, cancer survivors are at greater risk for developing second cancers as well as other diseases, such as heart disease and diabetes. It is well documented that heart disease and diabetes are clearly linked to weight gain.

Certain cancer treatments may alter the clients' body composition. Studies show that people with breast cancer, prostate cancer, non-small cell lung cancer, and acute lymphoblastic leukemia, who undergo chemotherapy, hormone therapy, or radiation therapy to the head, show unfavorable changes in their body composition. Their body fat increases and their lean muscle decreases. While their weight may not fluctuate dramatically on the scale, because of the increase in body fat, it is very likely that they will go up a size or two in their clothing.

The most important factors for weight gain in cancer clients seem to be the decrease in physical activity and the resulting lower basal metabolic rate. For those that can tolerate food, and have a propensity for over-eating, this will be a factor as well. In order to maintain their current body weight, clients should reduce their normal calorie intake and/or increase exercise, such as resistance training, that helps build muscle. Unfortunately, depending on the type of treatment, as well as the age and lifestyle of the individual, options may be somewhat limited. This is where the Cancer Exercise Specialist can make recommendations for the frequency, intensity, and duration of the exercises; as well as which are best suited for the individual client.

GENERAL RECOMMENDATIONS FOR WEIGHT CONTROL

Cancer clients are not alone in the never-ending struggle to reach and maintain their ideal body weight. It becomes even more of a priority, however, because a health body composition is associated with cancer prevention, more effective cancer treatment, the prevention of type II diabetes and heart disease, improved overall health and survival, increased ability to perform activities of daily living, and better quality of life.

It is easy to gain weight in a society that boasts "super-size" portions, "all you can eat buffets," and a "more is better" mentality. Making good choices requires discipline and self-control, but also being an educated consumer.

Here are some tips for making better choices:

- Choose foods with lower calorie content, such as vegetables, fruits, whole grains, and soups. Some of these foods also help a person feel "full" faster due to their high fiber content.
- Limit foods and beverages that are high in sugar and fat. Drink plenty of water (which will also produce the feeling of fullness without the added calories).
- Balance the calories from foods and beverages with the number of calories burned through physical activity. 3500 calories equal one pound. Therefore, eating a piece of cake that is 600 calories will require 600 calories of physical activity in order to burn it off. If the daily caloric intake exceeds the daily caloric expenditure, weight gain will occur.
- Increase levels of physical activity. Clients that are suffering from extreme fatigue and other treatment side-effects should try to do some form of physical activity every day; even if it's just a five-minute walk. For clients who were sedentary prior to their diagnosis, even a slight increase in physical activity will show marked improvement. On the other hand, those who were very active prior to treatment will probably be frustrated with their inability to perform at the level they have become accustomed to. It will be imperative for them to reduce their caloric intake in accordance with the reduction in physical activity in order to maintain their weight.
- If your client was overweight or obese prior to their cancer diagnosis, they should take steps to lose weight through nutrition and exercise. Body composition is the key component. If the scale does not show a marked change, but their lean muscle to body fat ratio improves, that is still a step in the right direction.

Many people with cancer find themselves needing to gain weight. As a result of certain cancer surgeries and treatments, clients may have loss of appetite. This is exacerbated by nausea, vomiting, mouth sores, difficulty swallowing, and loss of taste. A registered dietitian who specializes in working with cancer clients can make recommendations for adding calories and improving nutrition. Counseling provided by a registered dietitian can help clients and survivors who have completed treatment lose or gain weight. Weight loss plans, that are initiated prior to treatment and include exercise, have also helped people with cancer avoid weight gain during chemotherapy. Weight loss in people with cancer or cancer survivors should be closely monitored and reported to their doctor and, like the general population, no more than 2 pounds should be lost each week.

ALCOHOL AND CANCER RISK

WHAT IS ALCOHOL?

Alcohol is a legal, sedative drug which changes the way we feel. Pure alcohol is a colorless, odorless and inflammable fluid that does not contain any nutrients for the body. Alcohol is the common term for ethanol or ethyl alcohol, a chemical substance found in beer, wine, and liquor, as well as in some medicines, mouthwashes, household products, and essential oils.

Alcohol Content in different kinds of Beer, Wine and Liquor

Beer:

- 3.5% Heineken Premium Light, Amstel Light
- 4% Guinness Black
- 4.2% Bud/Coors Light
- 4.4% Yuengling
- 4.6% Corona Extra
- 5% Coors/Budweiser/MGD/Stella Artois
- 5% Heineken
- 5.6% Sierra Nevada Pale Ale
- 8.4% Tripel Karmeliet (Belgium ale)
- 9% Dogfish Head 90 Minute IPA (Imperial IPA)

Wine:

- 5-6.5% Moscato d'Asti
- 7-8% German Riesling
- 10.5-12% Most American, Austrian and Australian Riesling
- 11.5-12.5% Lambrusco (sparkling red/rosé)
- 12-13% Most Pinot Grigio
- 12.5-13% Most Beaujolais
- 12.5-13% Most Sauvignon Blanc
- 13%-14% Most Pinot Noir and Red Bordeaux
- 13.5% – 15% Malbec
- 13-14.5%% Most Chardonnay
- 13.5-14.5% Most Cabernet Sauvignon, Sangiovese and French Syrah
- 14 – 15% Most Shiraz and American Syrah
- 14.5% Sauternes (sweet white dessert wine)
- 14- 15.5% Most Zinfandel
- 14 – 15% Most Grenache
- 15% Muscat (sweet dessert wine)
- 15.9% Rombauer and Rancho Zabaco Zinfandel
- 16% Mollydooker Shiraz
- 17-21% Port, Madeira, Sherry, Other Fortified Dessert Wines
- 17-20% Sake

Hard Liquor

- 55-60% Cask strength whiskey/scotch
- 35-30% Gin
- 35-46% Vodka
- 40-46% Whiskey, Scotch, Rum, and Tequila

Alcoholic beverages are classified by the International Agency for Research on Cancer as a Group 1 carcinogen [195]. IARC classifies alcoholic beverage consumption as a cause of female breast, colorectum, larynx, liver, esophagus, oral cavity, and pharynx cancers; and as a probable cause of pancreatic cancer [195].

EVIDENCE OF THE LINK BETWEEN ALCOHOL CONSUMPTION AND CANCER RISK

In its Report on Carcinogens, the National Toxicology Program of the US Department of Health and Human Services lists consumption of alcoholic beverages as a known human carcinogen [196]. The research shows a distinct correlation between the amount of alcohol a person drinks, and a higher risk of developing an alcohol-associated cancer [196]. Based on a study by Andrew T. Kunzmann, Helen G. Coleman, Wen-Yi Huang, Sonja I. Berndt - The association of lifetime alcohol use with mortality and cancer risk in older adults: A cohort study – PLOS Medicine. Published: June 19, 2018, cancer incidence (excluding nonmelanoma skin cancer), and combined risk of cancer and death across categories of self-reported average lifetime alcohol intakes, with adjustment for potential confounders was calculated. During 836,740 person-years of follow-up (median 8.9 years), 9,599 deaths and 12,763 primary cancers occurred. Positive linear associations were observed between lifetime alcohol consumption and cancer-related mortality and total cancer incidence.

In November of 2017, The American Society of Clinical Oncology (ASCO) released a statement about alcohol and cancer risk stating: research has proven that alcohol is connected to more than 5% of cancer diagnoses around the world, including several types of head and neck cancers, esophageal cancer, liver cancer, breast cancer, and colon cancer [197].

HOW DOES ALCOHOL INCREASE THE RISK OF CANCER?

The risk of cancer associated with alcohol consumption is higher in tissues in closest contact on ingestion of alcohol, such as the oral cavity, pharynx and esophagus [49-51]. This is explained by the fact that ethanol is a proven mutagen and in addition, metabolite of ethanol (acetaldehyde) produced in the liver is highly carcinogenic, thus explaining both local (mouth, throat, esophageal cancers) as well as distant (skin, liver, breast) cancers [49-51]. Recent evidence suggests that the cytotoxic effect of ethanol on the cells lining the oral cavity, pharynx and esophagus activates the division of the stem cells located in deeper layers of the mucosa to replace the dead cells [196,197]. Every time stem cells divide, they become exposed to unavoidable errors associated with cell division and become highly vulnerable to the genotoxic activity of DNA-damaging agents (e.g., acetaldehyde and tobacco carcinogens) [196,197]. A study found that "the ADH1C*1 allele and genotype ADH1C*1/1 were significantly more frequent in patients with alcohol-related cancers [50].

Alcohol may cause damage to body tissues by acting as an irritant, especially in the mouth and throat [49-51,197]. Cells that are damaged may try to repair themselves, which could lead to DNA changes in the cells that can be a step toward cancer [49-51,197]. In the colon and rectum, bacteria can convert alcohol into large amounts of acetaldehyde; a chemical that has been shown to cause cancer in lab animals [49-51,197].

Alcohol damages the liver, leading to inflammation and scarring [48-51]. As liver cells try to repair the damage, they can end up with mistakes in their DNA, which could lead to cancer [48-51]. Alcohol can act as a solvent, helping other harmful chemicals, such as those in tobacco smoke, enter the cells lining the upper digestive tract more easily [48-51]. This could explain why smoking and drinking is much more likely to cause cancers in the mouth or throat than either one by itself.

Alcohol use can lower the body's ability to absorb folate from foods (cells in the body need Folate to stay healthy) [48-51,197]. This is a bigger issue in heavy drinkers who often do not get enough nutrients, folate included, in their diet [48-51,197]. Low folate levels may play a role in the risk of breast and colorectal cancers [48-51,197].

Alcohol can raise body levels of estrogen (a hormone important in the growth and development of breast tissue) and can affect a woman's risk of **breast cancer** [48-51,197].

In a study by ***Jasmine A. McDonald, PhD, Abhishek Goyal, MD, MPH, and Mary Beth Terry, PhD - Alcohol Intake and Breast Cancer Risk: Weighing the Overall Evidence - Curr Breast Cancer Rep. 2013 Sep; 5(3): 10.1007/s12609-013-0114-z. doi: 10.1007/s12609-013-0114-z,*** authors conclude that alcohol consumption is associated with a modest increase in breast cancer risk. This association has been consistently found in case-control and cohort studies, reducing the likelihood that it could be explained by selection or information biases. Effect modification of this relationship by the ADH1C genotype, and the associations between alcohol use and higher breast density, provide further evidence in support of a causal effect. Although the majority of the studies to date do not support increased breast cancer risk with higher alcohol use in women at high risk of breast cancer, prospective studies are needed to rule out biases. Although the literature is relatively scant, studies also do not suggest that alcohol affects breast cancer recurrence or survival. Thus, until prospective data become available for women across the spectrum of breast cancer risk, the best evidence suggests that higher risk women are not at increased risk from moderate alcohol consumption.

In another study by ***Allen NE, Beral V, Casabonne D, et al. (March 2009). "Moderate alcohol intake and cancer incidence in women". Journal of the National Cancer Institute,*** women drinking an average of two units of alcohol per day have an 8% higher risk of developing breast cancer than women who drink an average of one unit of alcohol per day. The study concluded that for every additional drink regularly consumed per day, the incidence of breast cancer increases by 11 per 1000. Approximately 6% (between 3.2% and 8.8%) of breast cancers reported in the UK each year could be prevented if drinking was reduced to a very low level (i.e. less than 1 unit/week), according to The Committee on Carcinogenicity of Chemicals in Food Consumer Products and the Environment (COC) [198]. Moderate to heavy consumption of alcoholic beverages (at least three to four drinks per week) is associated with a 1.3-fold increased risk of the recurrence of breast cancer [197,198]. Furthermore, consumption of alcohol at any quantity is associated with significantly increased risk of relapse in breast cancer survivors [197,198].

A World Cancer Research Fund panel finds the evidence "convincing" that alcoholic drinks increase the risk of **colorectal cancer** in men at consumption levels above 30 grams of absolute alcohol daily [195]. The National Cancer Institute states, "Heavy alcohol use may also increase the risk of colorectal cancer." [182,192]. A 2011 meta-analysis found that alcohol consumption was associated with an increased risk of colorectal cancer [49-51,97,197,198].

ALCOHOL USE DURING AND AFTER CANCER TREATMENT

The American Cancer Society states that alcohol use during cancer treatment can contribute to the development of new cancers [199]. Even in very small amounts alcohol can irritate, and sometimes make worse, mouth sores caused by chemotherapy [199]. Alcohol can also interact with some drugs used during cancer treatment, which might increase the risk of harmful side effects [199]. Your client should speak to their doctor about the possible contraindications with their personal treatment plan.

Alcohol is nothing but wasted calories, adding extra calories to the diet, which can contribute to weight gain in some people.

Many of your clients will be struggling with weight gain during and after their treatment has ended, and alcohol will only serve to make the problem worse. One serving of alcohol on average contains 100-150 calories, so even a moderate amount of 3 drinks a day can contribute 300+ calories. Mixed drinks that add juice, tonic, or syrups will further drive up calories, increasing the risk of weight gain over time. In addition, being overweight is known to increase the risks of many types of cancer so we should encourage food and drink with high nutritional value as you will read about in the next section.

CONQUERING CANCER WITH NUTRITION GLENN B. GERO, N.D., R.N.C., M.H., C.E.S., C.L.C.

There's no longer a question that a good diet is essential for optimal health. We know that the foods we eat, and our lifestyle affect our health. Food, nutrition and physical activity are crucial to our general health and well-being. The same way that our lifestyle choices affect our daily health, it also affects our long-term risk of developing diseases such as cancer. There have been scores of scientific research validating the association of poor dietary choices and the onset of degenerative diseases including cancer. As a matter of fact, according to The American Institute for Cancer Research, it is estimated that between 60 and 70 percent of all cancers have been directly linked to our daily dietary and lifestyle habits. On the other side of the coin, according to the Institute, we can achieve dramatic reductions in our cancer risk by making small adjustments to our daily dietary choices. A significant body of evidence has demonstrated that certain foods, for example, can offer benefits to people already afflicted with cancer either because they help to treat the condition, bolster immune response or because they can potentiate the effectiveness of other conventional or integrative therapies.

Because certain types of cancer treatments can cause immunocompromization, and make people susceptible to infection, food handling and safety is a legitimate concern. All cooking surfaces and utensils should be thoroughly cleaned; this includes sponges that come in contact with raw meat and raw eggs. Eggs and meat should be cooked thoroughly, and all foods should be promptly stored in the refrigerator to minimize bacterial growth. When eating at a restaurant during treatment, avoid foods that are likely to be contaminated with bacteria; undercooked meats, salad bar items, and sushi.

PRIMARY NUTRITIONAL GOALS

There are three main nutritional goals for someone living with cancer. They are 1) to maintain a healthy bodyweight; 2) to select a nutritional plan that will supply the body with fuel and nutrients for repair and healing and aid in the body's ability to eliminate toxins; and 3) to prevent recurrence of the cancer and the development of the second malignancy. While it may be overwhelming to administer radical alterations in food choices, it's got to be understood that if one refuses to make substantive modifications in their lifestyle, everything will stay the same; hence, one's cancer risk and the potential for recurrence will remain unaltered.

THE GLOBAL POPULATION IS GETTING FATTER

According to the World Health Organization (WHO), overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health. A crude population measure of obesity is the body mass index (BMI), a person's weight (in kilograms) divided by the square of his or her height (in meters). A person with a BMI of 30 or more is generally considered obese. A person with a BMI equal to or more than 25 is considered overweight. Within the overweight population, 600 million adults and 150 million children have body mass index numbers above 30. In the UK, being overweight/obese is the biggest cause of cancer after smoking, according to Cancer Research UK. According to the Centers for Disease Control (CDC), overweight/obesity account for 40% of all cancers in the United States. About 2.2 billion people around the world are either overweight or obese, and it is leading to health problems and a rising number of deaths, according to The Global Burden of Disease Study. About 2,300 researchers from 133 countries collaborated on the report, which was funded by the Bill and Melinda Gates Foundation and overseen by the Institute for Health Metrics and Evaluation at the University of Washington. The United States had the highest percentage of obese children and young adults at nearly 13 percent, but Egypt had the highest number of adults at 35 percent. Bangladesh had the lowest rates of obese children, and Vietnam the lowest number of adults - in both cases the percentage hovers around 1 percent. The frequency of obesity has doubled in more than 70 countries since 1980, the study said.

Researchers predict that at the current rise in the incidence of obesity, cancer rates may escalate by 50 percent by the year 2020. The premise is that being significantly overweight and inactive produces dramatic hormonal and metabolic changes that create the optimum environment for the onset and proliferation of cancer cells. Simply put, the secret to effective and sustained weight control is a five-part process.

1. **Move toward a plant-based diet -** consuming mineral rich foods fulfill the body's need for nutrients and provides lower calorie and higher fiber foods that usually reduce unhealthy cravings

2. **Watch your portion sizes -** condition yourself to eat only when you're hungry and only as much as your body requires. Pausing after each forkful to take a couple of deep breaths will enhance portion consciousness.

3. **Keep physically active -** exercise burns calories, regulates metabolism, relieves stress and may reduce the urge to eat

4. **Go slowly -** crash diets, skipping meals and excessive exercise are usually short-lived and fail 97 percent of the time. A carefully planned program of a gradual weight reduction, focusing on healthy eating and exercising will provide sustained results.

5. **Learn to control our response to life's stresses -** this may play a major role in weight maintenance and uncontrolled cravings and binging. It is the regrets of the past and the fears of the future that proliferate much of our unresolved stress. Learning to live in the present can often have a dramatic effect on our ability to reduce stress in our lives.

Achieving and maintaining a healthy body weight is an essential component of cancer prevention and treatment. Gradually reducing body fat and keeping it off is a strong step in the direction to help protect against cancer and assist in its treatment. Although every cancer patient requires an individual nutritional and therapeutic protocol, there are some important general guidelines which may give the body the best chance of preventing or recovering from cancer or other debilitating degenerative diseases.

1. EAT YOUR GREENS, REDS, ORANGES, YELLOWS AND PURPLES

A diet rich in fruits and vegetables is the best bet for preventing cancer. That fact has been supported and endorsed by the U.S. government agencies and by virtually every major medical organization, including the American Cancer Society. Selecting foods of different colors – red, orange, yellow, green and purple – you'll be getting a full spectrum of compounds that contribute to optimal health and have the greatest potential to protect and possibly even reverse catastrophic diseases like cancer.

The American Institute for Cancer Research reports, "if the only change people made was to eat at least five servings of fruits and vegetables each day, cancer rates could drop by at least 20 percent." Eating fruit and vegetables are our most natural and absorbable source of vitamins and minerals. This should be our primary sources of these nutrients. Synthetic pills that are produced in a laboratory cannot replace the vitality that real food can offer. These plant-based whole foods containing natural substances are called phytochemicals.

These phytochemicals have demonstrated the potential to modulate cancer development. There are many biologically plausible reasons why consumption of plant foods might slow or prevent the appearance of cancer. These include the presence in plant foods of such potentially anticarcinogenic substances as carotenoids, chlorophyll, flavonoids, indole, isothiocyanate, polyphenolic compounds, protease inhibitors, sulfides, and terpenes. Many experts refer to these compounds as chemo preventers to emphasize their potent anti-cancer effects. While these powerful phytochemicals work in harmony with antioxidants like vitamin C, vitamin E and selenium, they offer even considerably greater protection against cancer.

The specific mechanisms of action of most phytochemicals in cancer prevention are not yet clear, but they appear to be varied. Considering the large number and variety of dietary phytochemicals, their interactive effects on cancer risk may be extremely difficult to assess. Phytochemicals can inhibit carcinogenesis by inhibiting certain cancer-causing enzymes, curtail the mutation of DNA, suppress the abnormal proliferation of early cancerous lesions, and inhibit certain properties of the cancer cell.

Optimally, we should consume at least ten servings of fruits and vegetables each day. Choose a variety of colors of produce to get the most benefit. An orange with breakfast, apple for mid-morning snack, tossed salad and mixed fruit for lunch, raw veggies for an afternoon snack, two types of vegetables for supper and a late-night banana add up to ten.

2. CONSUME THE FATS THAT HEAL

There is indisputable evidence that a diet rich in saturated fats and cholesterol have been linked to cancer. Both the American Cancer Society and the National Cancer Institute recommend a diet that supplies less than 30 percent of dietary calories from fat. Just as important, however, is the type of fat consumed. Along with decreasing total fat intake, it is important to increase the intake of omega-3 fatty acids.

Cancer scientists continue to find cancer-fighting potential in omega-3 fatty acids. Omega3s are the type of polyunsaturated fat found mainly in fatty fish like salmon and, to a lesser extent, in certain vegetables, nuts, seeds and oils. Human and laboratory studies show evidence that omega-3s may lower cancer risk.

W. Elaine Hardman, Ph.D., a researcher at the Pennington Biomedical Research Center of Louisiana State University explains, "Populations in countries that consume high amounts of omega-3 fatty acids from fish have lower incidences of breast, prostate and colon cancer than in countries than consume less Omega-3s." In laboratory studies funded by the American Institute for Cancer Research, Hardman has found that supplementing the diet with omega-3s can reduce occurrence of tumors.

Omega-3s may also help cancer therapy's effectiveness. In other laboratory studies, Dr. Hardman found that adding fish oil to the diet can slow tumor growth, help chemotherapy drugs work more effectively and reduce side effects from other cancer treatments.

Unlike fish oil which is high in omega-3 polyunsaturated fatty acids, fats that are high in omega-6 polyunsaturated fatty acids (like corn oil), can proliferate the growth of tumors. Using a chemical carcinogen-induced cancer model, researchers found that a high intake of fish oil significantly lowered the cancer incidence in animal studies as compared to animals fed either low fat diets or diets high in corn oil. By implanting human tumors into immune-deficient mice, researchers have found that a high fish oil diet can slow tumor growth. These results suggest that fish oil can be used for both prevention and treatment of cancer.

Although there is no clear mechanism to explain fish oil's significant anticancer effects, researchers have uncovered several potential models of action:

- Alteration of cell membrane composition. After ingestion, fish oil is easily incorporated into cell membranes (especially tumor cells) which change the cell membrane composition. This alteration will change the cell's response to growth factor, hormones, antibodies, etc.
- Inhibition of prostaglandin production. Prostaglandins can stimulate tumor cell growth. Fish oil can inhibit the enzyme responsible for prostaglandin synthesis called prostaglandin synthase. After a high intake of fish oil, prostaglandin (especially in the tumor cells) is decreased significantly, which in turn slows tumor growth?
- Fish oil can enhance immune system stimulation
- Hormone profile changes, which may provide important benefits for hormone-related cancers like breast cancer
- Tumor cell toxicity, probably by causing lipid peroxidation (or oxidative deterioration) in the tumor cells

One of the big concerns in cancer treatment is metastasis, the process by which tumor cells spread from the primary location to distant parts of the body. Metastasis is increased by a high intake of omega-6 fatty acids (e.g., corn oil), but is inhibited by fish oil. Using an immune deficient mouse implanted with human breast cancer, researchers found that feeding a high fish oil diet (23%) to the mice significantly reduced human breast cancer cell metastasis to the regional lymph nodes and lungs. This indicates the significant beneficial effects of fish oil supplementation in cancer treatment.

Researchers at Allie M. Lee Cancer Research Laboratory at the University of Nevada, Reno, first declared that fish oil supplementation may be of benefit in cancer chemotherapy. By using a human breast cancer model, they found that feeding the animals a high fish oil diet both slowed the tumor growth and increased the tumor responsiveness to chemotherapy drugs by altering the drug activating systems. They also found that a high fish oil diet can significantly protect the host animals against the toxicity of chemotherapy drugs.

3. REDUCE THE EXPOSURE TO PESTICIDES

In the United States, more than 1.2 billion pounds of pesticides and herbicides are sprayed or added to food crops every year. Exposure to these chemicals damages the body's detoxification mechanisms, thereby increasing the risk of getting cancer and other serious diseases.

Let's think about the seriousness of this situation. Farmers in this country live a fairly healthy diet compared to those living in metropolitan areas. They have constant access to fresh fruit and vegetables, they breathe clean air, get plenty of exercise, they have a lower rate of cigarette smoking and significantly less alcohol and drug dependency. Yet studies indicate that farmers have a higher risk of developing leukemia's, lymphomas and cancers of the stomach, prostate, brain and skin.

There is also significant evidence that there is a correlation between exposure to pesticides and the risk of non-Hodgkin's lymphoma. This blood cancer currently accounts for about 3 percent of all cancers diagnosed in the United States. As we have recently seen in the Monsanto Roundup Lawsuit, weed killer has been designated as a probable human carcinogen by the World Health Organization (WHO). Farmers, farm workers, landscapers and gardeners who use Roundup or other glyphosate products are at risk for developing non-Hodgkin lymphoma and other forms of cancer. In 1985, the Environmental Protection Agency (EPA) classified glyphosate as a Group C chemical, determining that glyphosate was possibly carcinogenic to humans. This finding was based on early animal studies, which showed increased incidence of cancer in mice exposed to glyphosate. In 1991, however, after heavy lobbying by Monsanto, the EPA re-evaluated the animal data and re-classified glyphosate as a Group E chemical, indicating that there was no evidence that glyphosate herbicides like Roundup causes cancer in humans. This re-classification occurred shortly before Monsanto's launch of Roundup Ready seeds and set the stage for what would become a $6 billion a year product for Monsanto.

In 1991, Monsanto hired Craven Laboratories to perform various pesticide and herbicide studies, including studies for Roundup. Later that year, the owner of Craven Laboratories and three of its employees were indicted for fraudulent laboratory practices. In 1996, the New York Attorney General filed a Roundup lawsuit against Monsanto for falsely advertising the weed killer as being "safer than table salt" and "practically non-toxic" to mammals, birds and fish.

The New York Attorney General alleged in the Roundup lawsuit that Monsanto was falsely telling farmers and agricultural workers that Roundup was non-toxic. On June 20, 2017, six individuals from Wisconsin, Illinois, California, New York, New Jersey, and Florida filed a class action lawsuit against Monsanto alleging the company falsely promoted Roundup as interfering with an enzyme found only in plants, but not "in people or pets."

There are close to 1,000 cases nationwide claiming Monsanto's Roundup product was directly responsible for people developing NHL and other forms of cancer. Cases are being heard in the California federal court and in the Missouri and Delaware state courts. The cases against Monsanto are strengthening as the evidence is now concrete. On April 17, 2018, the court held a Final Approval Hearing in relation to the Roundup cases. On May 25, 2018, a Memorandum and Order Granting Final Approval of the Class Settlement was issued. However, Monsanto appealed against this on June 14, 2018, which has resulted in a delay of payments. However, consequences and reverberations are already being felt. This is true not just for Monsanto, but also for all other companies that have used glyphosate in their products. Cheerios, a product manufactured by General Mills, for instance, also contains glyphosate. While few people had looked at the link between glyphosate in food and cancers, now that the Johnson verdict is in, they have started to come forward.

In August of 2018, Consumer Affairs reported that laboratory tests commissioned by the Environmental Working Group (EWG) found oat cereals, oatmeal, granola, and snack bars contain traces of the herbicide. The EWG report said glyphosate showed up in all but two of 45 samples of products made with conventionally grown oats. Nearly 75 percent of the samples in the study had glyphosate levels higher than what EWG scientists consider protective of children's health. The chemical even showed up in several samples of organic oats.

Anresco Laboratories in San Francisco, an FDA-registered food safety lab, recently conducted their own research to see whether glyphosate can be found in commonly consumed processed foods. And their tests revealed the worst. Previous research has shown that glyphosate or glyphosate residues of only 0.05 parts per billion (ppb) can cause damage to at least 4,000 genes, while 10 ppb may cause serious health effects, such as kidney and liver damage. Anresco's results, however, indicated that some of the tested foods had up to 1,000 times that amount.

The testing and analysis were requested by Food Democracy Now! and The Detox Project, who bundled the results in a 29-page report called **"Glyphosate: UNSAFE ON ANY PLATE."** According to the report, U.S. regulators currently allow a very high level of daily glyphosate residues in our food. The authors hope their report can serve as a strong wake-up call for all Americans to reconsider their consumption of some of their favorite processed foods.

Furthermore, Food Democracy Now! has called for a federal investigation into the damaging effects of glyphosate and the relationships between the industry and the regulators that allow these toxins to end up in our food chain.

Below you'll find an overview of common brand names and the amount of glyphosate that was found in some of their products, with General Mills Cheerios topping the list with an astonishing 1,125.3 ppb.

Glyphosate Food Testing Results: (in parts per billion – ppb)

General Mills		
Cheerios	Original Cheerios	Glyphosate - 1,125.3 ppb AMPA – 26.4
Honey Nut Cheerios	Honey Nut Cheerios	Glyphosate – 670.2 ppb AMPA – 14.5
WHEATIES	Wheaties	Glyphosate – 31.2 ppb
Trix	Trix	Glyphosate - 9.9 ppb
Annie's	Gluten Free Bunny Cookies Cocoa & Vanilla	Glyphosate – 55.13* ppb
Kellogg's		
Kellogg's CORN FLAKES	Corn Flakes	Glyphosate – 78.9 ppb
Kellogg's Raisin Bran	Raisin Bran	Glyphosate – 82.9 ppb
Kashi	Organic Promise**	Glyphosate - 24.9 ppb
Kellogg's Special K	Special K	Glyphosate - 74.6 ppb
Kellogg's FROSTED FLAKES	Frosted Flakes	Glyphosate - 72.8 ppb
CHEEZ-IT	Cheez-It (Original)	Glyphosate – 24.6 ppb
CHEEZ-IT	Cheez-It (Whole Grain)	Glyphosate – 36.25* ppb
Kashi	Soft-Baked Cookies, Oatmeal Dark Chocolate	Glyphosate – 275.58* ppb
Nabisco		
RITZ	Ritz Crackers	Glyphosate – 270.24 ppb
Triscuit	Triscuit	Glyphosate – 89.68 ppb
OREO	Oreo Original	Glyphosate – 289.47* ppb

Food Democracy Now! Glyphosate: Unsafe on Any Plate 5

Chart source: Food Democrazy Now! – Glyphosate: UNSAFE ON ANY PLATE.

While pesticides may increase risk, they are not necessarily the only factor involved. The presence of pesticides should not deter us from eating fruit and vegetables. As a matter of fact, the levels of pesticides are lower in these foods than in those found in animal fats, meat, cheese, whole milk and eggs. Additionally, the antioxidants found in fruits and vegetables are necessary to help the body deal with the pesticides.

Here are some recommendations to reduce exposure of pesticides:

- Don't over consume animal fats, non-organic eggs and conventional dairy products
- Buy organic products when possible
- Peel skin from outer layers (which also contain many nutrients) or wash produce thoroughly with a biodegradable cleanser, then rinse

4. AVOID FOODS THAT CREATE A "NUTRITIONAL DEBT"

Imagine that you just got a new job and, after completing your first 40-hour work week, your boss approaches you with some bad news. "The company isn't doing very well and we, unfortunately, don't have enough money to pay you." This is analogous to our refined, high calorie, low nutrient junk food diet. Our body must expend energy to digest food that offers little in return, robbing us of the vitamins, minerals, phytonutrients and enzymes that we need to perform all of our physiological functions optimally.

Beware of foods high in sugars, refined flours, excess sodium, artificial sweeteners, trans or hydrogenated fats, corn syrups and deep fried anything. Reach instead for the "good stuff." A diet high in nutrient dense foods will protect immune response, heighten energy production, enhance mood, and balance blood sugar and insulin levels, all of which may reduce our risk of developing cancer.

Some guidelines for making better nutritional choices include:

- Read labels. If sugar, partially-hydrogenated fat, salt or "enriched flour" is listed as one of the first several ingredients, don't buy it. If your foods are naturally rich in nutrients, they don't need to be enriched, salted, sweetened or hydrogenated. Look for grain products that contain 3 grams of fiber or more per serving.
- Be aware of ingredients such as sucrose, glucose, maltose, lactose, fructose, corn syrup or white grape juice concentrate, which indicates that sugars have been added
- Look for the percentage of fat calories to total calories, as well as the number of fats grams per serving. For every 5 grams of fat in a serving, you are eataing the equivalent of one teaspoon of fat.

5. REDUCE ANIMAL PRODUCTS

One basic truth that seems to be confirmed from study to study is the fact the higher the intake of meat and other animal foods, the higher the cancer risk, especially for the major cancers, such as colon, breast, prostate and lung cancers.

According to noted naturopath Dr. Michael Murray, there are many reasons for this association. "Meat," Dr. Murray explains, "lacks the antioxidant and phytochemicals that protect us from cancer. At the same time, it contains lots of saturated fat and other potentially carcinogenic compounds - including pesticide residues, heterocyclic amines and polycyclic aromatic hydrocarbons, which form when meat is grilled, fried or broiled. The more well done the meat, the higher the level of amines."

While there is significant controversy, the actual risks associated with a diet high in animal products is associated with our demand for tender cuts of meat, which have compromised the nutritional value and safety of our animal food supply. Grain-fed cattle are tortured and restrained in tiny cubicles, injected with hormones and fed an unnatural grain and dairy diet. These measures have altered the fat composition of domestic cattle. Domestic beef contains primarily saturated fats and virtually no beneficial omega-3 fatty acids, while the fat of range-fed or wild animals contain more than five times the polyunsaturated fat per gram and has substantial amounts (about 4 percent) of omega-3 fatty acids.

Some sensible guidelines in choosing animal products include:

- Limit daily portions to about the size of the palm of your hand
- Avoid overcooked, charbroiled, deep-fried or overly-fatty meats
- Read labels and avoid meats preserved with nitrates, nitrites or msg
- Buy organic grass-fed, free-range poultry, beef, buffalo, ostrich or venison
- Only consume organic eggs from free-range chickens

6. SELECT FOODS AND SPICES THAT WILL HELP DETOXIFY THE BODY

The National Cancer Institute estimates that roughly one-third of all cancer deaths may be diet related. What you eat can hurt you, but it can also help you. Many of the common foods found in grocery stores or organic markets contain cancer-fighting properties, from the antioxidants that neutralize the damage caused by free radicals to the powerful phytochemicals that scientists are just beginning to explore. There isn't a single element in a particular food that does all the work. The best thing to do is eat a variety of foods.

The following foods have the ability to detoxify the body, help stave off cancer and some can even help inhibit cancer cell growth or reduce tumor size:

- **Apples** are a good source of fiber and vitamin C. most of the antioxidant power they provide comes from phytochemicals including: Quercetin (a flavonoid that shows anti-inflammatory and antioxidant properties, other flavonoids including epicatechin, and in red apples, anthocyanins, and triterpenoids are found especially in apple peel.
- **Avocados** are rich in glutathione, a powerful antioxidant that attacks free radicals in the body by blocking intestinal absorption of certain fats. They also supply even more potassium than bananas and are a strong source of beta-carotene. Scientists also believe that avocados may also be useful in treating viral hepatitis (a cause of liver cancer), as well as other sources of liver damage.
- **Blueberries** are an excellent source of vitamins C & K, manganese, and a good source of dietary fiber. Blueberries are among the fruits highest in antioxidant power, largely due to their many phytochemicals including anthocyanins, catechins, quercetin, kaempferol, and other flavonoids, ellagitannins and ellagic acid, and pterostilbene and resveratrol.
- **Broccoli, green & red cabbage, kale, collard greens, brussel sprouts, rapini, and cauliflower** have a chemical component called indole-3-carbinol that can combat breast cancer by converting a cancer-promoting estrogen into a more protective variety. Broccoli, especially sprouts, also have the phytochemical sulforaphane, a product of glucoraphanin - believed to aid in preventing some types of cancer, like colon and rectal cancer. Sulforaphane induces the production of certain enzymes that can deactivate free radicals and carcinogens. The enzymes have been shown to inhibit the growth of tumors in laboratory animals. However, be aware that the Agriculture Department studied 71 types of broccoli plants and found a 30-fold difference in the amounts of glucoraphanin. It appears that the more bitter the broccoli, the more glucoraphanin it contains. Broccoli sprouts have been developed under the trade name BroccoSprouts that have a consistent level of sulforaphane - as much as 20 times higher than the levels found in mature heads of broccoli. Broccoli, Brussels sprouts, cauliflower and rapini are all excellent sources of folate, a B vitamin, while Broccoli and Brussels sprouts are good sources of dietary fiber and rich in magnesium. Broccoli, Brussels sprouts and rapini contain carotenoids such as beta-carotene. Red cabbage and radishes supply anthocyanins. Other cruciferous vegetables provide different polyphenols, such as hydroxycinnamic acids, kaempferol and quercetin.
- **Carrots** contain a lot of beta carotene, which may help reduce a wide range of cancers including lung, mouth, throat, stomach, intestine, bladder, prostate and breast. A substance called falcarinol that is found in carrots has been found to reduce the risk of cancer, according to researchers at Danish Institute of Agricultural Sciences (DIAS). Kirsten Brandt, head of the research department, explained that isolated cancer cells grow more slowly when exposed to falcarinol. This substance is a polyacethylen, however, so it is important not to cook the carrots.
- **Cayenne (Red Pepper)** contains a chemical, capsaicin, which may neutralize certain cancer-causing substances (nitrosamines) and may help prevent cancers such as stomach cancer.

- **Cherries** are a good source of fiber and vitamin C, and they contain potassium. Tart cherries, but not sweet cherries or tart cherry juice, are also an excellent source of vitamin A. Cherries contain a variety of phytochemicals contributing both color and antioxidant activity: The fruit's dark red color comes from their high content of anthocyanins, which are antioxidants. Hydroxycinnamic acid and perillyl alcohol, a phytochemical from the monoterpene family, provide cherries' antioxidant power. Both sweet and tart cherries supply these antioxidant substances, though tart cherries contain more. The antioxidants in cherry juice and dried cherries (both unsweetened and sweetened) are similar to fresh cherries, according to available data. Frozen cherries' antioxidant content is somewhat lower. Canned cherries' decreases further but remains significant.

- **Coffee** varies with how the beans are grown and how you prepare it. Overall, coffee is a good source of the B vitamin riboflavin and is also a concentrated source of antioxidant phytochemicals. Coffee contains chlorogenic acid, an antioxidant compound that is the major phenol in coffee, Quinic acid, a phytochemical that contributes to the acidic taste of coffee, Cafestol and kahweol, compounds that are extracted from the beans' oil during brewing. Unfiltered coffee, such as French press or boiled coffee, contains these compounds, and N-methylpyridinium (NMB), created by roasting, may make the antioxidants more potent. Chlorogenic acid may be slightly lower in decaf coffee according to limited research, but it still contains plenty of phytochemicals. Lab studies suggest that instant may be lower in antioxidant potency than brewed coffee, though more research is needed.

- **Cranberries** are good sources of vitamin C and dietary fiber. They're very high in antioxidant power, most of which comes from phytochemicals: flavonoids, including anthocyanins, proanthocyanidins and flavonols, benzoic acid and hydroxycinnamic acidand ursolic acid.

- **Figs** apparently have a derivative of benzaldehyde. It has been reported that investigators at the Institute of Physical and Chemical Research in Tokyo say benzaldehyde is highly effective at shrinking tumors. Fig juice, additionally, is also a potent bacteria killer in test tube studies.

- **Flax** contains lignans, which may have an antioxidant effect and block or suppress cancerous changes. Flax is also high in omega-3 fatty acids, which are thought to protect against colon cancer and heart disease.

- **Garlic** has immune-enhancing allium compounds (dialyl sultides) that appear to increase the activity of immune cells that fight cancer and indirectly help break down cancer causing substances. These substances also help block carcinogens from entering cells and slow tumor development. Diallyl sulfide, a component of garlic oil, has also been shown to render carcinogens in the liver inactive. Studies have linked garlic, as well as onions, leeks and chives to a lower risk of stomach and colon cancer. According to a report in the October 2000 issue of the American Journal of Clinical Nutrition, people who consume raw or cooked garlic regularly face about half the risk of stomach cancer and two-thirds the risk of colorectal cancer as people who eat little or none. Their studies didn't show garlic supplements had the same effect. It is believed garlic may help prevent stomach cancer because it has anti-bacterial effects against a bacterium, helicobacter pylori, found in the stomach and known to promote cancer there.

- **Grapefruits,** like oranges and other citrus fruits, contain monoterpenes, believed to help prevent cancer by sweeping carcinogens out of the body. Some studies show that grapefruit may inhibit the proliferation of breast-cancer cells in vitro. Grapefruits also contain beta-carotene and lycopene (pink and red varieties). **Grapefruit can interfere with the activity of some medicines, both prescription and non-prescription.**

- **Grapes,** red contain bioflavonoids, powerful antioxidants that work as cancer preventives. Grapes are also a rich source of resveratrol, which inhibits the enzymes that can stimulate cancer cell growth and suppress immune response. They also contain ellagic acid, a compound that blocks enzymes that are necessary for cancer cells - this appears to help slow the growth of tumors. Both grapes and grape juice are rich sources of **resveratrol,** a type of natural phytochemical that belongs to a much larger group of phytochemicals called **polyphenols.** The skin of the grape contains the most resveratrol, and red and purple grapes contain significantly more resveratrol than green grapes. Grape jam and raisins contain much smaller amounts of this phytochemical. Red wine also contains resveratrol. However, with AICR's second expert report noting convincing evidence that alcohol is associated with increased risk for cancers of the mouth, pharynx and larynx, esophagus, breast (pre- and postmenopausal) and colon and rectum (in men), wine is not a recommended source of resveratrol. Studies suggest that polyphenols in general and resveratrol possess potent antioxidant and anti-inflammatory properties. In laboratory studies, resveratrol prevented the kind of damage known to trigger the cancer process in cell, tissue and animal models. Other laboratory research points to resveratrol's ability to slow the growth of cancer cells and inhibit the formation of tumors in lymph, liver, stomach and breast cells. Resveratrol has also triggered the death of leukemic and colon cancer tumors. In one series of studies, resveratrol blocked the development of skin, breast and leukemia cancers at all three stages of the disease (initiation, promotion and progression).

- **Green tea** has been used since ancient times as both beverage and medicine. Both black and green teas contain numerous active ingredients, including polyphenols and flavonoids, which are potent antioxidants. One class of flavonoids called catechins has recently become the focus of widespread study for their anti-cancer potential. Tea is the best source of catechins in the human diet, and green tea contains about three times the quantity of catechins found in black tea. In laboratory studies, green tea has been shown to slow or completely prevent cancer development in colon, liver, breast and prostate cells. Other studies involving green tea have shown similar protective effects in tissues of the lung, skin and digestive tract. Studies that track the diets of human subjects over several years (particularly studies conducted in Asia, where green tea consumption is common) have also associated regular usage of green tea with lower risk for bladder, colon, stomach, pancreatic and esophageal cancers.

- **Kale** has indoles; nitrogen compounds which may help stop the conversion of certain lesions to cancerous cells in estrogen-sensitive tissues. In addition, isothiocyanates, phytochemicals found in kale, are thought to suppress tumor growth and block cancer-causing substances from reaching their targets.

- **Licorice root** has a chemical, glycyrrhizin that blocks a component of testosterone and, therefore, may help prevent the growth of prostate cancer. Excessive quantities of licorice, however, may cause high blood pressure.

- **Mushrooms** appear to help the body fight cancer and build the immune system - they include: Shiitake, maitake, reishi, Agaricus blazei Murill, and Coriolus Versicolor. These mushrooms contain polysaccharides, especially lentinan, powerful compounds that help in building immunity. They are a source of Beta Glucan. They also have a protein called lectin, which attacks cancerous cells and prevents them from multiplying. They also contain Thioproline. These mushrooms can stimulate the production of interferon in the body.

- **Nuts** contain the antioxidants quercetin and campferol that may suppress the growth of cancers. Brazil nuts contain 80 micrograms of selenium, which is important for those with prostate cancer.

- **Oregano**, as reported in the Journal of Agriculture and Food Chemistry has the potential to destroy human cancer cells. Additionally, oregano has powerful antioxidant properties, due in large part to its rosmarinic acid (RA) content. Oregano oil increases oxygen levels in the blood, giving more energy, better athletic performance and mental clarity.

- **Papayas** have vitamin C that works as an antioxidant and may also reduce absorption of cancer-causing nitrosamines from the soil or processed foods. Papaya contains folacin (also known as folic acid), which has been shown to minimize cervical dysplasia and certain cancers.

- **Raspberries** contain many vitamins, minerals, plant compounds and antioxidants known as anthocyanins that may protect against cancer. According to a recent research study reported by Cancer Research 2001;61:6112-6119, rats fed diets of 5% to 10% black raspberries saw the number of esophageal tumors decrease by 43% to 62%. A diet containing 5% black raspberries was more effective than a diet containing 10% black raspberries. Research reported in the journal Nutrition and Cancer in May 2002 shows black raspberries may also thwart colon cancer. Black raspberries are rich in antioxidants, thought to have even more cancer-preventing properties than blueberries and strawberries.

- **Rosemary** may help increase the activity of detoxification enzymes. An extract of rosemary, termed carnosol, has inhibited the development of both breast and skin tumors in animals. We haven't found any studies done on humans. Rosemary can be used as a seasoning. It can also be consumed as a tea: Use 1 tsp. dried leaves per cup of hot water; steep for 15 minutes.

- **Seaweed and other sea vegetables** contain beta-carotene, protein, vitamin B12, fiber and chlorophyll, as well as chlorophylones - important fatty acids that may help in the fight against breast cancer. Many sea vegetables also have high concentrations of the minerals: potassium, calcium, magnesium, iron and iodine.

- **Soy** is one of the few plant foods with all the amino acids your body needs to make protein. You may see claims on food packages linking soy protein to lower risk of coronary heart disease. Because soy contains estrogen-like compounds, there is fear that soy may raise risk of hormone-related cancers. Soy's possible effects on health are an active area of research. Soy foods are good sources of protein, and many are also good sources of fiber, potassium, magnesium, copper and manganese. Soy foods contain significant iron, but it's not clear how well our bodies absorb it. Soymilk, tofu made with calcium, and soybeans are good sources of calcium. Soy is also a good source of polyunsaturated fat, both the omega-6 (linoleic acid) and omega-3 (alpha-linolenic) types. Soy contains a variety of phytochemicals and active compounds: Isoflavones: a group of phytoestrogens that includes genistein, daidzein and glycitein, Saponins: studies suggest these compounds may lower blood cholesterol, protect against cancer and affect blood glucose levels, Phenolic Acids: this group of phytochemicals is being studied for their potential to stop cancer cells from spreading, Phytic Acid: commonly found in cereals and legumes, it can act as an antioxidant, Enzyme-regulating proteins: these include protease inhibitors and protein kinase inhibitors, and Sphingolipids: they seem to play a role in regulating cell growth, self-destruction of abnormal cells and progression of tumors.

- **Sweet potatoes** contain many anticancer properties, including beta-carotene, which may protect DNA in the cell nucleus from cancer-causing chemicals outside the nuclear membrane.

- **Tomatoes** contain lycopene, an antioxidant that attacks roaming oxygen molecules, known as free radicals that are suspected of triggering cancer. It appears that the hotter the weather, the more lycopene tomatoes produce. They also have vitamin C, an antioxidant which can prevent cellular damage that leads to cancer. Watermelons, carrots and red peppers also contain these substances, but in lesser quantities. It is concentrated by cooking tomatoes (tomato paste being the richest source). Scientists in Israel have shown that lycopene can kill mouth cancer cells. An increased intake of lycopene has already been linked to a reduced risk of breast, prostate, pancreas and colorectal cancer. (Note: Recent studies indicate that for proper absorption, the body also needs some oil along with lycopene.)

- **Tumeric** (curcuma longa), a member of the ginger family, is believed to have medicinal properties because it inhibits production of the inflammation-related enzyme cyclooxygenase 2 (COX-2), levels of which are abnormally high in certain inflammatory diseases and cancers, especially bowel and colon cancer. In fact, a pharmaceutical company, Phytopharm, in the UK, hopes to introduce a natural product, P54 that contains certain volatile oils, which greatly increase the potency of the turmeric spice.

- **Turnips** are said to contain glucose molaes which is a cancer fighting compound.

- **Walnuts -** black walnuts are American natives, but English walnuts have become one of the most popular nuts in the United States. Although all nuts fit into a cancerpreventive diet, walnuts are most studied for cancer. They contain the omega-3 fat – alpha-linolenic acid, which can make walnuts more susceptible to becoming rancid. That's why you won't find them in most commercial nut mixes. Walnuts contain high amounts of polyphenols, phytochemicals that have antioxidant properties. They also contain a broad range of other potentially protective compounds: phytosterols, plant compounds known to help lower blood cholesterol that are under study for their potential antioxidant and anti-inflammatory effects in the body. They also contain melatonin, a hormone and antioxidant. Walnuts are an excellent source of copper and manganese, and a good source of magnesium.

- **Water** is essential for life. The average amount of water in the body is about 10 gallons. We need to drink at least 48 ounces of water per day to replace the water that is lost through urination, sweat and breathing. Pure water is a universal detoxifier. In the body, it helps to remove waste materials and clear out toxins. It also helps carry oxygen and nutrients to all cells. Maintaining proper body hydration provides a foundation for both health and wellness.

- **Whole grains** are good sources of fiber and magnesium and provide some protein. Individual whole grains vary; several types are also good sources of manganese, thiamin, niacin, vitamin B-6 and/or selenium. A variety of healthful compounds in whole grains combine to make these foods high in potential anti-cancer activity. Phytic acid, present in grains and legumes, is being studied in the prevention of cancer and protease inhibitors may prevent cancer cells from spreading.

- **Winter squash** are excellent sources of vitamin A, good sources of vitamin C and dietary fiber. They are also a good way to get potassium. Winter squash, including pumpkins, are rich in carotenoids, including beta-carotene and alpha-carotene: these carotenoids can act as antioxidants. Also, our bodies convert these to vitamin A, a nutrient important for immune function and maintaining healthy cells among other roles. They also contain lutein and zeaxanthin: these yellow pigmented carotenoids help protect eye health by filtering high-energy ultraviolet rays that can damage our eyes' lens and retina. They act as antioxidants here and possibly elsewhere in our bodies.

SUPPLEMENTAL INSURANCE FOR PREVENTING CANCER

Dietary supplements are secondary to a sound diet plan because we can't guarantee that even the best diet offers the optimum nutrients our bodies need. Depleted soils, environmental toxins, impure water, physical demands and psychological stresses heighten our nutritional requirements.

The following few supplements are some of the key recommendations which may significantly reduce the risk of cancer:

- A food-based, multiple vitamin and mineral, especially one that offers adequate levels of anti-oxidants, serves as insurance against major nutrient deficiencies. Being food-based, they generally include important phytonutrients and detoxifying enzymes. Additionally, having a natural food base enhances its absorbability.

- Green drinks are made by drying the juice from one or more of several plants. As these plants are typically 90% water, the usual serving (1/2 ounce or 20 capsules) of the green powder roughly equals one serving of a green vegetable. An extra serving of green vegetable each day doesn't sound like much, but on average, we Americans eat only two servings per day. As mentioned above, according to the National Cancer Institute, even a small increase in vegetable intake would reduce the risk of ovarian cancer, for instance, by about 20%. Chlorophyll is the substance all green drinks have in common.

- Chlorophyll structure is almost identical to hemoglobin, except chlorophyll has a magnesium atom where hemoglobin has an iron atom. Our bodies require magnesium to utilize the energy we obtain from our food, and chlorophyll from plants is an important dietary source of this essential mineral. The plants most often used to make green drinks are two single-cell organisms, chlorella and spirulina, and the young leaves of alfalfa, barley or wheat. Besides being rich sources of magnesium, these plants supply reasonable amounts of protein, vitamin E, and essential fatty acids such as gamma linolenic acid, an essential fatty acid that is hard to obtain in the typical American diet. Just as it is prudent to consume a varied diet, it is sensible to use a mixture of the dried greens. A wide variety of other foods are often mixed in with several of green foods, which is okay if the greens are the main ingredient. In addition to known nutrients, chlorella also has something called Chlorella Growth Factor that may aid in human tissue repair. Researchers have also described complex sugars in chlorella that are 100 and 1,000 times more powerful than those currently used clinically for cancer immunotherapy. These complex sugars appear to be cell-to-cell messenger chemicals that stimulate white cells. It is less expensive and tastier, no doubt, to acquire nutrients from whole foods, but if your lifestyle makes it prohibitively difficult to eat as you should, we are fortunate that in America another option exists.

- Probiotics or beneficial bacteria can alter certain enzymes that turn procarcinogens into carcinogenic agents. The "bad" bacteria that secrete these destructive enzymes include clostridium and certain bacteroides, among others. Obviously, the more dangerous enzymes that are present in our gastrointestinal tract, the greater our risk harboring cancer-causing substances. The ability of these active super strains of beneficial bacteria that can neutralize these harmful enzymes is one of the most important contributions to cancer prevention. The immune system's workload is further complicated by the need to cleanse the body of an increasing number of extraneous pollutants and contaminants found in the environment and the food chain. Overloaded with work, the immune system needs all the help it can get from our friendly bacteria. When disease-causing aliens can permeate the intestinal walls and enter the bloodstream, the immune system must spring into action. If strong colonies of friendly bacteria line the intestinal tract in full force, these harmful microorganisms will not be able to get through, thus lightening the already heavy workload of the immune system. Through scientific research, it has been determined that friendly bacteria can reduce the threat of potential cancer-causing agents in the body and increase the body's immune system to transform these agents into inactive carcinogens. Some cancer risk factors are under our control, especially diet. Supplementing the diet with probiotics, in addition to healthy dietary choices, is one way to help lower our risk of getting cancer. Additional supplements should be recommended, by your healthcare practitioner, on a case-by-case basis. The information contained in this chapter is for educational purposes only and should not be deemed medical advice. These ideas are not intended to replace the advice of a qualified healthcare practitioner. Neither the authors of this book or the publisher shall be liable or responsible for any loss, injury or damage allegedly arising from any information or suggestions in this book.

CHAPTER TWELVE

EXERCISE PROGRAMMING

When this sign is present, please note the contraindications and recommend with caution.

The exercise routine should begin with a cardiovascular warm-up: General Warm-Up - As with any exercise program, your client should begin their BOSU(R) Balance Trainer workout with a warm-up. The warm-up should include a minimum of five to ten minutes of continuous rhythmical movement. The purpose of the warm-up is to increase circulation and body temperature and prepare the body for exercise.

WARM-UP/BOUNCING ON THE BOSU® BALANCE TRAINER

Level 1 – The beginner should **NOT** do this warm-up without someone there to spot them. The spotter should stand in front of client and hold their hands continuously throughout the warm-up. The client should gently bounce up and down for five minutes, shifting their weight from one foot to the other.

*If the client is struggling, please go back to the general warm-up. After performing the general warm-up on several occasions, try **Level 1 warm-up on the BOSU® Balance Trainer again.** When the client is confident and stable at **Level 1 warm-up on the BOSU® Balance Trainer,** they may progress to **Level 2 warm-up on the BOSU® Balance Trainer.***

Level 2 - Have your client place the BOSU® Balance Trainer next to something stable (wall, rail, corner, etc.). If using a corner, the client will stand on the BOSU® Balance Trainer and face into the corner. If using a wall or rail, they may place the BOSU® Balance Trainer next to it. In either case, the client should be instructed to hold on for balance. They should gently bounce up and down for five minutes, shifting their weight from one foot to the other.

*If the client is struggling, please go back to the **Level 1 warm-up on the BOSU® Balance Trainer.** After performing the **Level 1 warm-up on the BOSU® Balance Trainer** on several occasions, have them try **Level 2 warm-up on the BOSU® Balance Trainer** again. When the client is confident and stable at Level 2 warm-up on the **BOSU® Balance Trainer,** they may progress to **Level 3 warm-up on the BOSU® Balance Trainer.***

Level 3 – The client wanting to try **Level 3 warm-up on the BOSU® Balance Trainer** should feel confident in their stability and balance and have been successful for a few weeks at **Level 2 warm-up on the BOSU® Balance Trainer.** At this advanced level, they should be able to perform the **warm-up on the BOSU® Balance Trainer** with no spot and no props.

*If the client is struggling, please have them go back to the **Level 2 warm-up Balance Trainer.** After performing the **Level 2 warm-up on the BOSU® Balance Trainer** on several occasions, have them try **Level 3 warm-up on the BOSU® Balance Trainer** again.*

Time on the BOSU® Balance Trainer can be increased as the client adapts to the training.

WARM-UP PRECAUTIONS

If your client has had lymph nodes removed or irradiated, it is CRITICAL that they do not wrap exercise bands around their affected arm as it may restrict circulation and bring on lymphedema. It will also be imperative that they begin with minimal repetitions and little to no resistance, making sure there is no swelling in the affected arm following each session. If there is no sign of swelling, they can gradually add more repetitions and greater resistance.

RECOMMENDED EXERCISES

These exercises are designed to improve range of motion and flexibility in the shoulder and chest areas, to restore strength to the shoulder and arm muscles, and to "train" the affected side to better handle the flow of lymph, all while strengthening the core musculature using the BOSU® Balance Trainer.

The following stretches are designed to open-up the chest following mastectomy, reconstruction, radiation, and/or lymph node dissection. Upon completion of your clients' personal assessment, if you noticed that their head was jutting forward and their palms were facing backward, it is safe to assume that they have some degree of upper-crossed-syndrome. This can also be exacerbated by sitting at a computer and performing daily tasks that require movement in front of the body.

UPPER-CROSSED SYNDROME (ROUNDED SHOULDERS AND FORWARD HEAD)

UCS PRECAUTIONS

If your client has expanders wait until the expanders have been removed before having them perform any exercises that work the chest eccentrically or concentrically.

If your client has breast implants, you will want to have them begin with limited ROM. It is rare, but possible, that the implants will move out of their "pocket" and need surgical correction.

If your client has undergone a unilateral TRAM Flap (only one side of their rectus abdominis has been sacrificed) they may need minor assistance in lowering themselves back onto the BOSU® Balance Trainer. On the other hand, if it is a bi-lateral Tram Flap, they will NOT be able to roll backwards or subsequently roll themselves back to an upright position without assistance. You may help them with this motion or instruct them to roll onto their side in order to get "in to" and "out of" the position.

There may come a point at which your client can perform this stretch and not feel a "stretch" any longer. While this is a positive outcome, do not take your client's newly discovered "flexibility' for granted. More often than not, without continued practice, the client will gradually lose the newly acquired flexibility and/or ROM. Therefore, it is essential that they continue with this stretch (at least periodically) into perpetuity.

Chest Expansion

Level 1 - Have your client sit upright on a chair with knees bent and both arms bent behind their head (palms face the head). Instruct them to gently expand their chest and simultaneously contract their shoulder blades until they feel a gentle stretching sensation. They should hold the stretch for 15-30 seconds, or as long as they can without pain. This can also be done with continuous movement; trying to go a bit further each time.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one foot off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

When the client is confident and can perform **Level 1 Chest Expansion** pain-free, they may progress to **Level 2 Chest Expansion on the BOSU® Balance Trainer.**

Level 2 - Instruct your client to sit upright in the center of the BOSU® Balance Trainer with knees bent and arms by their sides. Have them gently expand their chest and simultaneously contract their shoulder blades together. They should hold the stretch for 15-30 seconds or as long as they can without pain. This can also be done with continuous movement; trying to go a bit further each time. Alternatively, your client can place their arms behind their head (see photo below) while retracting their shoulder blades, engaging their abs, and keeping their head in alignment.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one foot off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

Level 2 - Alternative

Level 3 - Begin by having your client sit at the base of the BOSU® Balance Trainer. Instruct them to carefully lower themselves back until their head and mid back are supported by the BOSU® Balance Trainer. *If they have undergone a TRAM flap, they will need to roll sideways rather than "backwards" onto the BOSU® Balance Trainer.* Have them start by raising their arms straight up towards the ceiling with their palms facing each other. Instruct them to bend their elbows slightly as if hugging a barrel. They should allow their arms to slowly lower outward and toward the floor while maintaining a slight bend in their elbows. They should hold the stretch for 15-30 seconds or as long as they can without pain. This can also be done with continuous movement; trying to go a bit further each time.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one foot off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to **Level 2 Chest Expansion on the BOSU® Balance Trainer.** After performing **Level 2 Chest Expansion on the BOSU® Balance Trainer** several occasions, pain free, try **Level 3 Chest Expansion on the BOSU® Balance Trainer** again.

Modified

Level 3

Newton's Third Law of Physics states that *for every action there is an equal and opposite reaction. In the fitness world this is known as reciprocal inhibition.* In simple terms, if the chest muscles are contracted, the opposing back muscles have no option other than to stretch. Therefore, if we want to stretch the chest muscles, we must contract and strengthen the back muscles. The following exercises are designed to do just that. Because we are adding resistance to the exercises, you will want to have your client begin with the lightest resistance band possible and perform only a few repetitions. There are two things that you are looking for in terms of their body's response to these exercises. The first is that they are not in pain beyond slight muscle soreness the next day. The second is that there is no swelling in their affected arm that could suggest the onset of lymphedema. If they end up uncomfortably sore the next day, you were probably a bit ambitious and should use less resistance or no resistance (just go through the motions without a band or weights). If they have any noticeable swelling when they perform the *"pitting"* test, have them stop exercising, see their doctor, and make sure that they return with a medical clearance form giving them permission to resume exercising. Make sure to begin with fewer repetitions and lighter resistance next time around and carefully monitor to make sure there is not an increase in swelling. *If they are given a sleeve to wear, it is imperative that you require it during their exercise session.*

REVERSE FLY PRECAUTIONS

If your client has expanders wait until the expanders have been removed before having them perform any exercises that work the chest eccentrically or concentrically.

If your client has breast implants, you will want to have them begin with limited ROM. It is rare, but possible, that the implants will move out of their "pocket," and need surgical correction.

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has had lymph nodes removed or irradiated, it is CRITICAL that they do not wrap exercise bands around their affected arm as it may restrict circulation and bring on lymphedema. It will also be imperative that they begin with minimal repetitions and little to no resistance, making sure there is no swelling in the affected arm following each session. If there is no sign of swelling, they can gradually add more repetitions and greater resistance.

REVERSE FLY

Level 1 – This version of the reverse fly is an easier position for someone who has undergone a TRAM flap and has difficulty lowering themselves to the floor. The beginner should attempt this exercise sitting in a chair with no resistance to begin with. Instruct them to exhale, retract their shoulder blades, and simultaneously expand their chest as they open their arms out to the side (reverse barrel hug). Have them pause 1-2 seconds, inhale, and slowly return to starting position. Perform only a few repetitions initially and make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions and greater resistance.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor and holding that position for several seconds. Have them alternate lifting their right and then left foot off of the ground. When they are confident and stable, have them try lifting both feet off of the ground. Progress/regress as needed for the individual's fitness level.

Perform only a few repetitions with no resistance initially and make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions and greater resistance. When the client is confident and stable at **Level 1 Reverse Fly,** they may progress to **Level 2 Reverse Fly on the BOSU® Balance Trainer.**

Level 2 – The client should begin this exercise sitting upright in the center of the BOSU® Balance Trainer with both feet (sets of toes) in contact with the floor for maximum stability. Have them hold their arms straight out in front of them (parallel to the floor with palms facing each other) holding one end of an exercise band in each hand. Instruct them to exhale, expand their chest, and simultaneously squeeze their shoulder blades together as they pull the band out to their sides (make sure they keep a slight bend in their elbows throughout the motion. Have them pause 1-2 seconds, inhale, and slowly return to starting position. Perform only a few repetitions with resistance initially and make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions and greater resistance.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one foot off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to the **Level 1 Reverse Fly.** After performing the **Level 1 Reverse Fly** on several occasions, pain free, try **Level 2 Reverse Fly on the BOSU®Balance Trainer** again. When the client is confident and stable at **Level 2 Reverse Fly on the BOSU® Balance Trainer,** they may progress to **Level 3 Reverse Fly on the BOSU® Balance Trainer.**

Level 2

Level 3 – The client should begin this exercise standing in the center of the BOSU® Balance Trainer with both feet (sets of toes) in contact with the BOSU® Balance Trainer for maximum stability. Have them hold their arms straight out in front of them (parallel to the floor with palms facing each other) holding one end of an exercise band in each hand. Instruct them to exhale, expand their chest, and simultaneously squeeze their shoulder blades together as they pull the band out to their sides (make sure they keep a slight bend in their elbows throughout the motion). Have them pause 1-2 seconds, inhale, and slowly return to starting position. Perform only a few repetitions with resistance initially and make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions and greater resistance.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by lifting one heel off of the BOSU® Balance Trainer, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to **Level 2 Reverse Fly on the BOSU® Balance Trainer.** After performing the **Level 2 Reverse Fly on the BOSU® Balance Trainer** on several occasions, try **Level 3 Reverse Fly on the BOSU® Balance Trainer** again.

SUPINE REVERSE FLY – LEVEL 3 ALTERNATE OPTION

Instruct client to lie on their back with the back of their head and mid back supported by the BOSU® Balance. Their tail bone should be resting up against its' base and their knees should be bent with their thighs and feet parallel.

You can have them use the same "figure 8" band as pictured on page 16, or use the traditional band with handles as shown in the picture. Because they are not going to be using the handles, it is critical to note that they should not wrap the band around their hands as this may increase their risk for lymphedema by restricting circulation. Simply have them hold the band between their thumbs and forefingers. Their hands should be as far enough apart so that when they open their arms up and out to the side they feel a gentle amount of resistance, but it does not compromise their ability to perform the exercise.

Have them expand their chest and simultaneously squeeze their shoulder blades together as they pull band out to their sides (make sure they keep a slight bend in their elbows throughout the motion). Have them pause for 1-2 seconds, inhale, and slowly return to starting position. Perform only a few repetitions with resistance initially and make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions and greater resistance.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by lifting one foot off of the BOSU® Balance Trainer, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

ER PRECAUTIONS

If your client has undergone radiation and/or reconstruction as well as a mastectomy, there may be a significant amount of scar tissue build-up that will make external rotation quite challenging. As external rotation if performed, it will have the natural benefit of stretching the chest at the same time the posterior muscles are strengthened.

If your client has had lymph nodes removed or irradiated, it will be imperative that they begin with minimal repetitions and little to no resistance, making sure there is no swelling in the affected arm following each session. If there is no sign of swelling, they can gradually add more repetitions and greater resistance.

If your client has peripheral neuropathy in their hands, do not use a band or hand weights when performing the exercise.

If your client has peripheral neuropathy in their feet, only have them perform the Level 1 and Level 2 exercises.

EXTERNAL ROTATION

Level 1 – The beginner should perform this exercise sitting in a chair with no resistance to begin with. Instruct them to exhale, retract their shoulder blades, and simultaneously expand their chest as they rotate their arms out to the side (don't allow their elbows to break-away too far from their sides). Have them pause 1-2 seconds, inhale, and slowly return to starting position. Perform only a few repetitions initially and make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions and greater resistance.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one foot off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

Perform only a few repetitions with no resistance initially and make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions and greater resistance. When the client is confident and stable at **Level 1 External Rotation**, they may progress to **Level 2 External Rotation on the BOSU® Balance Trainer.**

Level 2 – The client should begin this exercise kneeling on the BOSU® Balance Trainer with both feet (sets of toes) in contact with the backside of the BOSU® Balance Trainer for maximum stability. Instruct them to exhale, retract their shoulder blades, and simultaneously expand their chest as they rotate their arms out to the side (don't allow their elbows to break-away too far from theirsides). Have them pause 1-2 seconds, inhale, and slowly return to starting position. Perform only a few repetitions with no resistance initially and make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions and greater resistance.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by lifting one set of toes off of the BOSU® Balance Trainer; and then have them try that with both feet. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to **Level 1 External Rotation.** After performing the **Level 1 External Rotation** on several occasions, try **Level 2 External Rotation on the BOSU® Balance Trainer** again. When the client is confident and stable at **Level 2 External Rotation on the BOSU® Balance Trainer,** they may progress to **Level 3 External Rotation on the BOSU® Balance Trainer.**

Level 2

Level 3 – The client should begin this exercise standing on the BOSU® Balance Trainer with both feet hip width apart and knees slightly bent. Instruct them to engage their abdominal muscles, retract their shoulder blades, and simultaneously expand their chest as they rotate their arms out to the side (don't allow their elbows to break-away too far from their sides). Have them pause 1-2 seconds, inhale, and slowly return to starting position. Perform only a few repetitions with resistance initially and make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions and greater resistance.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by lifting one foot off of the BOSU® Balance Trainer, but maintaining contact with the toes. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to **Level 2 External Rotation on the BOSU® Balance Trainer.** After performing the **Level 2 External Rotation on the BOSU® Balance Trainer** on several occasions, try **Level 3 External Rotation on the BOSU® Balance Trainer** again.

Level 3

ROW PRECAUTIONS

If your client has expanders wait until the expanders have been removed before having them perform any exercises that work the chest eccentrically or concentrically.

If your client has breast implants, you will want to have them begin with limited ROM. It is rare, but possible, that the implants will move out of their "pocket," and need surgical correction.

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has had lymph nodes removed or irradiated, it is imperative that they begin with minimal repetitions and little to no resistance, making sure there is no swelling in the affected arm following each session. If there is no sign of swelling, they can gradually add more repetitions and greater resistance.

If your client has osteoporosis in their lumbar spine DO NOT have them perform this exercise.

If your client has peripheral neuropathy in their hands, do not use a band or hand weights when performing the exercise.

If your client has peripheral neuropathy in their feet, only have them perform the Level 1 exercise.

ROW

Level 1 – Instruct your client to sit on a chair with their feet shoulder width apart. Have them bend forward or "hinge" at their waist and allow their arms to hang down with their palms facing each other. Instruct them to exhale, retract their shoulder blades, and bring both arms up at ninety-degree angles so that at the end of the movement their hands are next to their hips. Have them pause 1-2 seconds, inhale, and slowly return to starting position. Perform only a few repetitions with no resistance initially.

Make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by lifting one heel off of the BOSU® Balance Trainer, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Row,** they may progress to **Level 2 Row on the BOSU® Balance Trainer.**

Level 2 – Instruct your client to stand on the BOSU® Balance Trainer with their feet shoulder width apart. Have them bend forward or "hinge" at their waist and allow their arms to hang down with their palms facing each other. Instruct them to exhale, retract their shoulder blades, and bring both arms up at ninety-degree angles so that at the end of the movement their hands are next to their hips. Have them pause 1-2 seconds, inhale, and slowly return to starting position. Perform only a few repetitions with resistance initially and make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions and greater resistance.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by lifting one foot off of the BOSU® Balance Trainer, but maintaining contact with the toes. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to the **Level 1 Row** while sitting in a chair. After performing the **Level 1 Row** on several occasions, try **Level 2 Row on the BOSU® Balance Trainer** again.

Level 2

SHOULDER RANGE OF MOTION AND FLEXIBILITY

ROM AND FLEXIBILITY PRECAUTIONS

If your client has expanders wait until the expanders have been removed before having them perform any exercises that work the chest eccentrically or concentrically.

If your client has breast implants, you will want to have them begin with limited ROM. It is rare, but possible, that the implants will move out of their "pocket," and need surgical correction.

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, educate them on the safest way for them to mount and dismount from the BOSU® Balance Trainer.

If your client has undergone an axillary node dissection, they may struggle with scar tissue/adhesions in the axillary area (under the armpit) as well as across the chest wall. They should gently ease into the stretch and only go as far as they can, achieving a state of mild discomfort, but NO pain.

LAT & AXILLA STRETCH

Following mastectomy, node dissection, and/or radiation, this stretch will help to open the lymphatic pathways as well as increase range of motion.

Level 1 – Have your client lie on their side, on the floor, with unaffected arm bent beneath their head. Bend knees at roughly ninety-degrees. They may extend bottom leg for better balance. Begin with affected arm at their side, palm facing forward. Have them gradually raise that arm out to the side and up toward the ceiling (until their arm is perpendicular to their body). From that point, they may begin to slowly reach a bit further; listening to their body and stopping when they feel a gentle stretching sensation. They should hold the stretch for 15-30 seconds, or as long as they can ***without pain*** (make sure that they are not holding their breath or compensating their form). They can also do this with continuous movement, trying to go a slight bit further with each repetition.

Make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions.

When your client is confident and stable at **Level 1 Lat & Axilla Stretch,** they may progress to **Level 2 Lat & Axilla Stretch on the BOSU® Balance Trainer.**

Level 2 – Have your client lie on their side, over the BOSU® Balance Trainer, with unaffected arm bent beneath their head. Bend knees at roughly ninety-degrees. They may extend bottom leg for better balance. Begin with affected arm at their side, palm facing forward. Have them gradually raise that arm out to the side and up toward the ceiling (until their arm is perpendicular to their body). From that point, they may begin to slowly reach a bit further; listening to their body and stopping when they feel a gentle stretching sensation. Have them hold the stretch for 15-30 seconds, or as long as they can without pain (make sure that they are not holding their breath or compensating their form). They can also do this with continuous movement, trying to go a slight bit further with each repetition. Make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions.

If your client is struggling, please go back to **Level 1 Lat & Axilla Stretch.** After performing the L**evel 1 Lat & Axilla Stretch** on several occasions, try **Level 2 Lat & Axilla Stretch on the BOSU® Balance Trainer** again.

Level 2

ABDUCTION PRECAUTIONS

If your client has expanders wait until the expanders have been removed before having them perform any exercises that work the chest eccentrically or concentrically.

If your client has breast implants, you will want to have them begin with limited ROM. It is rare, but possible, that the implants will move out of their "pocket," and need surgical correction.

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, educate them on the safest way for them to mount and dismount from the BOSU® Balance Trainer.

If your client has undergone an axillary node dissection, they may struggle with scar tissue/adhesions in the axillary area (under the armpit) as well as across the chest wall. They should gently ease into the stretch and only go as far as they can, achieving a state of mild discomfort, but NO pain.

SHOULDER ABDUCTION

Level 1 – Have your client stand upright on the floor, creating somewhat of a ninety-degree angle with their left leg. Their right leg is out to the side for stability (make sure their foot is pointing forward). Instruct them to inhale and slowly raise their arm out to the side and up toward their ear. They will feel an intense stretch up their side, particularly if they have undergone an axillary node dissection and/or radiation to that area. They should go as far as they can without pain. From that point, they should begin to slowly reach a bit further; listening to their body and stopping when they feel a gentle stretching sensation. Have them hold the stretch for 15-30 seconds, or as long as they can ***without pain*** (make sure that they are not holding their breath or compensating their form). They can also do this with continuous movement, trying to go a slight bit further with each repetition.

Make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions.

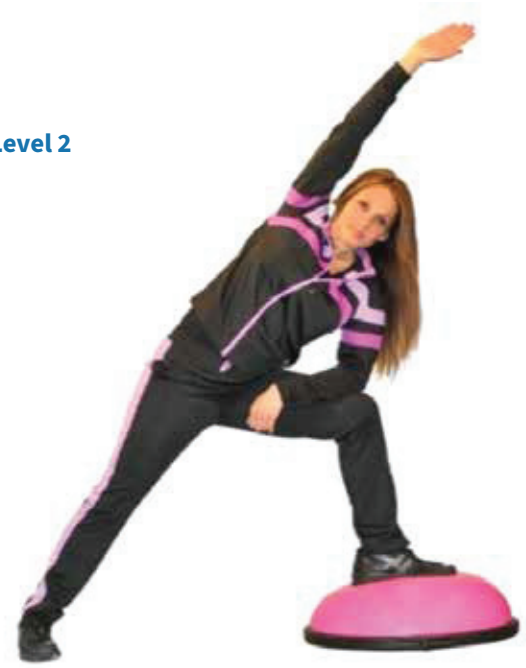
When the client is confident and stable at **Level 1 Shoulder Abduction,** they may progress to **Level 2 Shoulder Abduction on the BOSU® Balance Trainer.**

Level 2 - Have your client place their left foot on the BOSU® Balance Trainer, creating somewhat of a ninety-degree angle with their bent leg. Their right leg is out to the side for stability (make sure their foot is pointing forward). Instruct them to inhale and slowly raise their arm out to the side and up toward their ear. They will feel an intense stretch up their side, particularly if they have undergone an axillary node dissection and/or radiation to that area. They should go as far as they can without pain. From that point, they should begin to slowly reach a bit further; listening to their body and stopping when they feel a gentle stretching sensation. Have them hold the stretch for 15-30 seconds, or as long as they can ***without pain*** (make sure that they are not holding their breath or compensating their form). They can also do this with continuous movement; trying to go a slight bit further with each repetition.

Make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions.

If the client is struggling, please go back to **Level 1 Shoulder Abduction.** After performing the **Level 1 Shoulder Abduction** on several occasions, try **Level 2 Shoulder Abduction on the BOSU® Balance Trainer** again.

Level 2



FLEXION PRECAUTIONS

If your client has expanders wait until the expanders have been removed before having them perform any exercises that work the chest eccentrically or concentrically.

If your client has breast implants, you will want to have them begin with limited ROM. It is rare, but possible, that the implants will move out of their "pocket," and need surgical correction.

If your client has undergone a unilateral TRAM Flap (only one side of their rectus abdominis has been sacrificed) they may need minor assistance in lowering themselves back onto the BOSU® Balance Trainer. On the other hand, if it is a bi-lateral Tram Flap, they will NOT be able to roll backwards or subsequently roll themselves back to an upright position without assistance. You may help them with this motion or instruct them to roll onto their side in order to get "in to" and "out of" the position.

If your client has undergone an axillary lymph node dissection, they may have scar tissue in their armpit as well as across their chest. This, as well as the possibility of adhesions, can drastically limit their movement in shoulder flexion. Make sure that they begin with limited ROM as their body and "pain level" dictates. Be aware of excessive arching in their lower back as attempts to compensate are made.

SHOULDER FLEXION & AXILLA STRETCH

Level 1 – Have your client lie on their back on the floor with their knees at roughly ninety- degrees. Instruct them to ***slowly*** lower their arms backward and overhead, only allowing their arms to bend slightly. They will feel a slight pulling sensation in their chest and under their armpit (particularly if they underwent radiation and/or sentinel or axillary node dissection). Make sure that they ***stop*** when they feel a gentle stretching sensation. Have them hold the stretch for 15-30 seconds, or as long as they can ***without pain.*** They can also do this with continuous movement, trying to go slightly further with each repetition.

Make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions.

When your client is confident and stable at **Level 1 Shoulder Flexion & Axilla Stretch,** they may progress to **Level 2 Shoulder Flexion & Axilla Stretch on the BOSU® Balance Trainer.**

Level 2 - Instruct client to lie on their back with the back of their head and mid back supported by the BOSU® Balance Trainer (if your client has undergone a TRAM Flap, you will need to instruct them to roll up and down sideways, or assist them in lowering themselves and raising themselves from the BOSU® Balance Trainer). Their tail bone should be resting up against its' base and their knees should be bent with their thighs and feet parallel.

Instruct them to ***slowly*** lower their arms backward and overhead, only allowing their arms to bend slightly. They will feel a slight pulling sensation in their chest and under their armpit (particularly if they underwent radiation and/or sentinel or axillary node dissection). Make sure that they ***stop*** when they feel a gentle stretching sensation. Hold for 15-30 seconds, or as long as they can ***without pain.*** They can also do this with continuous movement, trying to go slightly further with each repetition.

Make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions.

If the client is struggling, please go back to **Level 1 Shoulder Flexion & Axilla Stretch** while lying on the floor. After performing the **Level 1 Shoulder Flexion & Axilla Stretch** on several occasions, try **Level 2 Shoulder Flexion & Axilla Stretch on the BOSU® Balance Trainer** again.

Level 2

EXTENSION PRECAUTIONS

If your client has expanders wait until the expanders have been removed before having them perform any exercises that work the chest eccentrically or concentrically.

If your client has breast implants, you will want to have them begin with limited ROM. It is rare, but possible, that the implants will move out of their "pocket," and need surgical correction.

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has undergone any type of mastectomy, they may struggle with scar tissue/adhesions across the chest wall. They should gently ease into the stretch and only go as far as they can, achieving a state of mild discomfort, but NO pain.

If your client has peripheral neuropathy in their feet, only have them perform the Level 1 and Level 2 exercises.

SHOULDER EXTENSION

Level 1 - Have your client stand on the floor with their legs hip width apart. Have them contract their abdominal muscles. Instruct them to slightly tuck their hips underneath them so that as they reach their arms backward, they do not sway their back. With their chest elevated and their arms hanging by their side, palms facing their thighs, instruct them to exhale and push their arms backward. Make sure that their head does not migrate forward and that they do not elevate (shrug) their shoulders. Have them go as far as they can without pain. From that point, they should begin to slowly reach a bit further; listening to their body and stopping when they feel a gentle stretching sensation. Have them hold the stretch for 15-30 seconds, or as long as they can *without pain* (make sure that they are not holding their breath or compensating their form).

Make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one foot off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at Level 1 Shoulder Extension, they may progress to **Level 2 Shoulder Extension on the BOSU® Balance Trainer.**

Level 2 – The client should begin this exercise kneeling on the BOSU® Balance Trainer with both feet (sets of toes) in contact with the back side of the BOSU® Balance Trainer for maximum stability. Have them contract their abdominal muscles. Instruct them to slightly tuck their hips underneath them so that as they reach their arms backward, they do not sway their back. With their chest elevated and their arms hanging by their side, palms facing their thighs, instruct them to exhale and push their arms backward. Make sure that their head does not migrate forward and that they do not elevate (shrug) their shoulders. Have them go as far as they can without pain. From that point, they should begin to slowly reach a bit further; listening to their body and stopping when they feel a gentle stretching sensation. Have them hold the stretch for 15-30 seconds, or as long as they can *without pain* (make sure that they are not holding their breath or compensating their form).

Make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by lifting one set of toes off of the BOSU® Balance Trainer: and then have them try that with both feet. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to **Level 1 Shoulder Extension.** After performing the **Level 1 Shoulder Extension** on several occasions, try **Level 2 Shoulder Extension on the BOSU® Balance Trainer** again. When the client is confident and stable at **Level 2 Shoulder Extension on the BOSU® Balance Trainer,** they may progress to **Level 3 Shoulder Extension on the BOSU® Balance Trainer.**

Level 3 - Have your client stand on the BOSU® Balance Trainer with their legs hip width apart. Have them contract their abdominal muscles. Instruct them to slightly tuck their hips underneath them so that as they reach their arms backward, they do not sway their back. With their chest elevated and their arms hanging by their side, palms facing their thighs, instruct them to exhale and push their arms backward. Make sure that their head does not migrate forward and that they do not elevate (shrug) their shoulders. Have them go as far as they can without pain. From that point, they should begin to slowly reach a bit further; listening to their body and stopping when they feel a gentle stretching sensation. Have them hold the stretch for 15-30 seconds, or as long as they can *without pain* (make sure that they are not holding their breath or compensating their form).

Make sure there is no swelling in the affected arm in the days to come. If there is no sign of swelling you can gradually add more repetitions.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by lifting one foot off of the BOSU® Balance Trainer, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to **Level 2 Shoulder Extension on the BOSU® Balance Trainer.** After performing the **Level 2 Shoulder Extension on the BOSU® Balance Trainer** on several occasions, try **Level 3 Shoulder Extension on the BOSU® Balance Trainer** again.

Level 3

ER PRECAUTIONS

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has undergone any type of mastectomy and/or breast reconstruction, they may struggle with scar tissue/adhesions across the chest wall. They should gently ease into the stretch and only go as far as they can, achieving a state of mild discomfort, but NO pain. They may find that laying prone on the BOSU® Balance Trainer is uncomfortable on their chest. Have them move forward on the BOSU® Balance Trainer until there is no contact with their chest. They may place a soft ball under their forehead to eliminate neck flexion.

EXTERNAL ROTATION

Level 1 - Instruct your client to lay prone (face down) on the floor with their arms to their side at roughly ninety degrees. If they find this position uncomfortable, have them place a pillow under their chest/stomach until they are comfortable (or they can try this in a side-lying position). Keeping their neck in neutral, go into very slight spinal extension, and have them externally rotate their shoulders. Have them hold the stretch for 15-30 seconds, or as long as they can *without pain* (make sure that they are not holding their breath or compensating their form). They can also do this with continuous movement, trying to go a slight bit further with each repetition.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one foot off of the floor. Next have them try to eliminate all contact with one foot. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 External Rotation,** they may progress to **Level 2 External Rotation on the BOSU® Balance Trainer.**

Level 2 -Instruct your client to lay prone on the BOSU® Balance Trainer with their abdomen on the bullseye and their arms to their side at roughly ninety degrees. If they find this position uncomfortable, have them move forward on the BOSU® Balance Trainer until there is no contact with their chest. Keeping their neck in neutral, go into very slight spinal extension, and have them externally rotate their shoulders. Hold for 15-30 seconds, or as long as they can *without pain* (make sure that they are not holding their breath or compensating their form). They can also do this with continuous movement, trying to go a slight bit further with each repetition.

For the client who is ready for a greater challenge, have them place an exercise ball between their feet on the inside of their legs. Instruct them to simultaneously adduct their thighs.

Level 2

If the client is struggling, please go back to **Level 1 External Rotation.** After performing **Level 1 External Rotation** on several occasions, try **Level 2 External Rotation on the BOSU® Balance Trainer** again.

CORE STRENGTH (THESE EXERCISES WILL PLAY A CRITICAL ROLE IN MINIMIZING LOW BACK PAIN AND CORRECTING SWAYBACK FOLLOWING AN ABDOMINAL TRAM OR DIEP FLAP)

FLEXION, BALANCE, CORE PRECAUTIONS

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has undergone any type of mastectomy and/or breast reconstruction, they may struggle with scar tissue/adhesions across the chest wall. They should gently ease into the stretch and only go as far as they can, achieving a state of mild discomfort, but NO pain. They may find that laying prone on the BOSU® Balance Trainer is uncomfortable on their chest. Have them move forward on the BOSU® Balance Trainer until there is no contact with their chest. They may place a soft ball under their forehead to eliminate neck flexion.

If your client has peripheral neuropathy in their feet, only have them perform the Level 1 exercise.

SHOULDER FLEXION, BALANCE, AND CORE SERIES

Level 1 - Have your client begin by standing on the floor with their feet shoulder width apart. They should practice doing squats a few times to get the movement down before trying to add the arms. *When they are performing squats, make sure that their thighs remain parallel and their knees point forward rather than bow out to the side. Only have them go as deep as they can without causing any knee pain.*

Give your client a ball and instruct them to hold it between their hands (begin with a tennis ball and work up to a weighted ball). Instruct them to inhale as they lower into a squat position, allowing their arms to drop between their legs. Have them keep their head and chest elevated as they begin to bend their legs. Instruct them how to contract their abdominal and buttock muscles and exhale as they begin to stand up and straighten their legs (make sure that they do not lock them out at the top of the movement – keep knees soft). As they straighten their body into an upright position, they will continue to raise their arms up overhead. Only have them go as far as they can without causing any pain in their shoulders. If you notice that they are buckling their elbows toward their sides in an effort to gain more range of motion, have them reduce their range of motion and work on better form. With practice, their range of motion will gradually improve.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one heel off of the floor, but maintaining contact with the toes. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Shoulder Flexion, Balance, and Core Series,** they may progress to **Level 2 Shoulder Flexion, Balance, and Core Series on the BOSU® Balance Trainer.**

Level 2 – Have your client begin by standing on the BOSU® Balance Trainer with their feet shoulder width apart. They should practice doing squats a few times to get the movement down before trying to add the arms. *When they are performing squats, make sure that their thighs remain parallel and their knees point forward rather than bow out to the side. Only have them go as deep as they can without causing any knee pain.*

Give them a ball and instruct them to hold it between their hands (begin with a tennis ball and work up to a weighted ball). Instruct them to inhale as they lower into a squat position, allowing their arms to drop between their legs. Have them keep their head and chest elevated as they begin to bend their legs. Instruct them how to contract their abdominal and buttock muscles and exhale as they begin to stand up and straighten their legs (make sure that they do not lock them out at the top of the movement – keep knees soft). As they straighten their body into an upright position, they will continue to raise their arms up overhead. Only have them go as far as they can without causing any pain in their shoulders. If you notice that they are buckling their elbows toward their sides in an effort to gain more range of motion, have them reduce their range of motion and work on better form. With practice, their range of motion will gradually improve.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by lifting the toes of one foot off of the dome, but maintaining contact with the heel. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to **Level 1 Shoulder Flexion, Balance, and Core Series.** After performing the **Level 1 Shoulder Flexion, Balance, and Core Series** exercise on several occasions, try **Level 2 Shoulder Flexion, Balance, and Core Series on the BOSU® Balance Trainer** again.

Option 1 – Have your client hold the ball between their hands (begin with a tennis ball and have them work their way up to a weighted ball). Instruct them to inhale as they lower into a squat position, reaching their arms to the center of their thighs. Instruct them to try and keep their head and chest elevated as they begin to bend their legs. Have them contract their abdominal and buttock muscles and exhale as they begin to stand up and straighten their legs (make sure that they do not lock them out at the top of the movement - keep knees slightly bent). As they straighten their body into an upright position, they will continue to raise their arms straight overhead. Only have them go as far as they can without causing any pain in their shoulders.

Option 2 – Have your client hold the ball between their hands (begin with a tennis ball and have them work their way up to a weighted ball). Instruct them to inhale as they lower into a squat position, reaching their arms to the right of their thighs. Instruct them to try and keep their head and chest elevated as they begin to bend their legs. Have them contract their abdominal and buttock muscles and exhale as they begin to stand up and straighten their legs (make sure that they do not lock them out at the top of the movement – keep knees). As they straighten their body into an upright position, they will continue to raise their arms from a diagonal position to straight overhead. Only have them go as far as they can without causing any pain in their shoulders.

Following a TRAM or DIEP Flap many of your clients may notice increased lower back pain. This is usually the result of swayback and a combination of weak, or inhibited, abdominal muscles and/or tight, or dominant, low back muscles. Unfortunately there are other muscles that may be contributing to this imbalance. This can include weak as well as tight low back musculature, poor core strength, tight hip flexors, and weak gluteal muscles to name a few. If these issues are not addressed it may lead to a chain reaction of lower extremity joint pain and degeneration over time. The following exercises are designed to address all of the possibilities and minimize the pain and dysfunction associated with this postural imbalance.

LOW BACK, GLUTEAL, AND HAMSTRING STRETCH WITH SHOULDER FLEXION

Option one – Have your client position themselves in the center of the BOSU® Balance Trainer with their legs crossed. Instruct them to inhale and slowly slide their hands forward on the floor in front of them (they can choose to have their hands palms down or palms facing each other). Hold for 15-30 seconds, or as long as they can ***without pain*** (make sure that they are not holding their breath or compensating their form). They can also do this with continuous movement, trying to go a slight bit further with each repetition. Make sure that they come back up slowly, engaging their abdominal muscles. If they are tight in their gluteal and hip muscles, this may be difficult to perform.

Option two – Have your client position themselves in the center of the BOSU® Balance Trainer with their knees bent and feet flat on the floor. Instruct them to inhale and slowly slide their hands forward on the floor in front of them (they can choose to have their hands palms down or palms facing each other). If they can do this with ease, they can challenge themselves by straightening their legs and pulling their toes toward their knees. Hold for 15-30 seconds, or as long as they can ***without pain*** (make sure that they are not holding their breath or compensating their form). They can also do this with continuous movement, trying to go a slight bit further with each repetition. Make sure that they come back up slowly, engaging their abdominal muscles.

LOW BACK PRECAUTIONS

If your client has osteoporosis in their lumbar spine DO NOT have them perform option one of this exercise.

If your client has undergone a bi-lateral TRAM Flap, they may need your assistance to return to an upright position.

QL STRETCH WITH SHOULDER FLEXION

Have your client position themselves in the center of the BOSU® Balance Trainer with their legs crossed. Have them inhale and slowly slide their hands toward the left on the floor in front of them. In order to get the best stretch, they will need to keep their right hip down and pressing toward the floor. They should feel the stretch on the lower right quadrant of their back - quadratus lumborum). Hold for 15-30 seconds, or as long as they can ***without pain*** (make sure that they are not holding their breath or compensating their form). Make sure that they come back up slowly, engaging their abdominal muscles. Repeat on the other side.

QL STRETCH PRECAUTIONS

If your client has osteoporosis in their lumbar spine, DO NOT have them perform Option 1 of this exercise.

GLUTEAL STRENGTH (THESE EXERCISES WILL PLAY A CRITICAL ROLE IN STRENGTHENING GLUTEAL MUSCLES AND STRETCHING HIP FLEXORS. THIS MAY HELP TO ALLEVIATE LOW BACK PAIN THAT MAY BE ASSOCIATED WITH WEAK GLUTEAL MUSCLES AND TIGHT HIP FLEXORS.

DONKEY KICK AND GLUTEAL PRECAUTIONS

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has had lymph nodes removed or irradiated, it is imperative that they begin with minimal repetitions and weight bearing on the affected shoulder, making sure there is no swelling in the affected arm following each session. If there is no sign of swelling they can gradually add more repetitions.

If your client has peripheral neuropathy in their hands, have them perform the exercise on their forearms with or without a bolster based on their "comfort" level.

It is inadvisable to remove a contact point with either wrist or forearm due to the amount of added pressure this may put on the affected arm/shoulder.

If your client has undergone a GAP Flap, please make sure that incisions are fully healed (at least 6-8 weeks) prior to performing this exercise. If they experience discomfort while contracting their gluteal muscles, heave them minimize the contraction and don't lift their hips as high.

DONKEY KICK

Level 1 – Have your client position themselves in a **quadraped** with hands and knees shoulder width apart on the floor (if this is too much stress on their shoulder or wrist joints they may position themselves on their forearms, with or without a bolster based on their "comfort" level instead). Begin with their left leg slightly bent, contracting their abdominal muscles, and extending their leg backward while flexing their foot. At the end of the motion they will also need to contract their gluteal muscles and make sure that they don't allow their back to "sway." Instruct them to repeat this several times on each leg. If their arms become fatigued, have them take a break and resume if they can.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by eliminating contact with the "stabilizing" foot. Progress/ regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Donkey Kick,** they may progress to **Level 2 Donkey Kick on the BOSU® Balance Trainer.**

Level 2 – Have your client position themselves in a quadraped with hands shoulder width apart in the front of the BOSU® Balance Trainer (if this is too much stress on their shoulder or wrist joints they may position themselves on their forearms, with or without a bolster based on their "comfort" level instead) and the right knee in the center of the BOSU® Balance Trainer. Begin with their left leg slightly bent, contracting their abdominal muscles, and extending their leg backward while flexing their foot. At the end of the motion they will also need to contract their gluteal muscles and make sure that they don't allow their back to "sway." Instruct them to repeat this several times on each leg. If their arms become fatigued, have them take a break and resume if they can.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by eliminating contact with the "stabilizing" foot. Progress/ regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Donkey Kick.** After performing the **Level 1 Donkey Kick** on several occasions, pain free, try **Level 2 Donkey Kick on the BOSU® Balance Trainer** again.

Level 2

GLUTEAL SQUEEZE

Level 1 – Have your client position themselves in a **quadraped** with hands and knees shoulder width apart on the floor (if this is too much stress on their shoulder or wrist joints they may position themselves on their forearms, with or without a bolster based on their "comfort" level instead). Begin with their left leg bent at ninety degrees and foot flexed. Have them contract their abdominal muscles and press their foot up towards the ceiling while contracting their gluteal muscles. The movement is very slight. They must keep their abdominal muscles taught and make sure that they don't allow their back to "sway." Instruct them to repeat this several times on each leg. If their arms become fatigued, have them take a break and resume if they can.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by eliminating contact with the "stabilizing" foot. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Gluteal Squeeze,** they may progress to **Level 2 Gluteal Squeeze on the BOSU® Balance Trainer.**

Level 2 – Have your client position themselves in a **quadraped** with hands shoulder width apart on the floor (if this is too much stress on their shoulder or wrist joints they may position themselves on their forearms, with or without a bolster based on their "comfort" level instead) and the right knee in the center of the BOSU® Balance Trainer. Begin with their left leg bent at ninety degrees and foot flexed. Have them contract their abdominal muscles and press their foot up towards the ceiling while contracting their gluteal muscles. The movement is very slight. They must keep their abdominal muscles taught and make sure that they don't allow their back to "sway." Instruct them to repeat this several times on each leg. If their arms become fatigued, have them take a break and resume if they can.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by eliminating contact with the "stabilizing" foot. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Gluteal Squeeze.** After performing **Level 1 Gluteal Squeeze** on several occasions, pain free, try **Level 2 Gluteal Squeeze on the BOSU® Balance Trainer** again.

Level 2

BRIDGE

Level 1 – Have your client lie supine on the floor with their arms by their sides (palms down) and knees bent (lined up over their ankles) shoulder width apart on the floor. Beginners should start by lifting their butt off of the floor while simultaneously pushing their hips up toward the ceiling and squeezing their gluteal (butt) muscles. Instruct them to pause at the top for 1-2 seconds. It is essential for them to engage their abdominal muscles as well so that they do not feel discomfort in their lower back. If they experience pain, try reducing the time that they remain in the "contracted" position. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. Progress/regress as needed for the individual's fitness level. They may lift the toes of the right and left feet off of the floor maintaining contact with just the heels.

When the client is confident and stable at **Level 1 Bridge,** they may progress to **Level 2 Bridge on the BOSU® Balance Trainer.**

Level 2 – Have your client lie supine over the BOSU® Balance Trainer with their arms by their sides (palms down), tailbone up against the base of the BOSU® Balance Trainer, and knees bent (lined up over their ankles) shoulder width apart on the floor. Instruct your client to begin by lifting their butt off of the floor while simultaneously pushing their hips up toward the ceiling and squeezing their gluteal (butt) muscles. Instruct them to pause at the top for 1-2 seconds. It is essential for them to engage their abdominal muscles as well so that they do not feel discomfort in their lower back. If they experience pain, try reducing the time that they remain in the "contracted" position.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. Progress/regress as needed for the individual's fitness level. They may lift the toes of the right and left feet off of the floor maintaining contact with just the heels. They may place both hands behind their head which will help to stretch their chest wall while increasing the balance challenge.

If the client is struggling, please go back to the **Level 1 Bridge.** After performing the **Level 1 Bridge** on several occasions, try the **Level 2 Bridge on the BOSU® Balance Trainer** again. When the client is confident and stable at the **Level 2 Bridge on the BOSU® Balance Trainer,** they may progress to **Level 3 Bridge on the BOSU® Balance Trainer.**

BRIDGE PRECAUTIONS

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises. If your client has undergone a unilateral TRAM Flap (only one side of their rectus abdominis has been sacrificed) they may need minor assistance in lowering themselves back onto the BOSU® Balance Trainer. On the other hand, if it is a bi-lateral Tram Flap, they will NOT be able to roll backwards or subsequently roll themselves back to an upright position without assistance. You may help them with this motion, or instruct them to roll onto their side in order to get "in to" and "out of" the position.

If your client has undergone a GAP Flap, please make sure that incisions are fully healed (at least 6-8 weeks) prior to performing this exercise. If they experience discomfort while contracting their gluteal muscles, heave them minimize the contraction and don't lift their hips as high.

Level 2

Level 3

Level 3 – Have your client lie supine on the floor with their arms by their sides (palms down), tailbone up against the base of the BOSU® Balance Trainer, and knees bent (lined up over their ankles) on top of the BOSU® Balance Trainer. Instruct your client to begin by lifting their butt off of the floor while simultaneously pushing their hips up toward the ceiling and squeezing their gluteal (butt) muscles. Instruct them to pause at the top for 1-2 seconds. It is essential for them to engage their abdominal muscles as well so that they do not feel discomfort in their lower back. If they experience pain, try reducing the time that they remain in the "contracted" position.

For the client who is ready for a greater balance challenge, have them remove their right foot from the BOSU® Balance Trainer and raise their right leg to the ceiling (foot flexed). Instruct them to "push" through their left foot and thigh, contract their left "glute" and push their left hip toward the ceiling. They may repeat several times on each leg or alternate as desired.

If the client is struggling, or in pain, please go back to the **Level 2 Bridge on the BOSU® Balance Trainer.** After performing the **Level 2 Bridge on the BOSU® Balance Trainer** on several occasions, pain free, try **Level 3 Bridge on the BOSU® Balance Trainer** again.

SUPERWOMAN

Level 1 – Have your client position themselves in a **quadraped** with hands and knees shoulder width apart on the floor (if this is too much stress on their shoulder or wrist joints they may position themselves on their forearms, with or without a bolster based on their "comfort" level instead). Have your client begin by extending their left arm, contracting their abdominal muscles, and extending their right leg backward while flexing their foot. At the end of the motion they will also need to contract their gluteal muscles and make sure that they don't allow their back to "sway." Perform several repetitions and increase as their comfort level and strength dictates. If their arms become fatigued, have them take a break and resume if they can.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by eliminating contact with the "stabilizing" toes. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Superwoman,** they may progress to **Level 2 Superwoman on the BOSU® Balance Trainer.**

Level 2 – Have your client position themselves in a **quadraped** with hands shoulder width apart in the front of the BOSU® Balance Trainer (if this is too much stress on their shoulder or wrist joints they may position themselves on their forearms, with or without a bolster based on their "comfort" level instead) and the left knee in the center of the BOSU® Balance Trainer. Have your client begin by extending their left arm, contracting their abdominal muscles, and extending their right leg backward while flexing their foot. At the end of the motion they will also need to contract their gluteal muscles and make sure that they don't allow their back to "sway." Instruct them to alternate this several times on each leg. If their arms become fatigued, have them take a break and resume if they can.

Level 2

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by eliminating contact with the "stabilizing" toes. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Superwoman.** After performing the **Level 1 Superwoman** on several occasions, pain free, try **Level 2 Superwoman on the BOSU® Balance Trainer** again.

SUPERWOMAN PRECAUTIONS

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has had lymph nodes removed or irradiated, it is imperative that they begin with minimal repetitions and weight bearing on the affected shoulder, making sure there is no swelling in the affected arm following each session. If there is no sign of swelling they can gradually add more repetitions.

If your client has peripheral neuropathy in their hands, have them perform the exercise on their forearms with or without a bolster based on their "comfort" level.

It is inadvisable to remove a contact point with either wrist or forearm due to the amount of added pressure this may put on the affected arm/shoulder.

OBLIQUE TWIST

Level 1 - Instruct your client to sit upright on a chair while holding a weightless ball in their hands. Instruct them to engage their abdominal muscles and slowly rotate their torso from side-to-side (make sure that they remain upright). Remind them to look forward and keep their hips locked in place so that the rotation comes from their waist. Perform several repetitions in each direction and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one heel off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot, and then both. You can also increase the weight of the ball as tolerated. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Oblique Twist,** they may progress to **Level 2 Oblique Twist on the BOSU® Balance Trainer.**

Level 2 - Instruct your client to sit upright in the center of the BOSU® Balance Trainer with knees bent while holding a weightless ball in their hands. Instruct them to engage their abdominal muscles and slowly rotate their torso from side-to-side (make sure that they remain upright). Remind them to look forward and keep their hips locked in place so that the rotation comes from their waist. Perform several repetitions in each direction and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one heel off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot, and then both. You can increase the weight of the ball as tolerated, as well as have them "track" the ball with their eyes from side-to-side. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to the **Level 1 Oblique Twist.** After performing the **Level 1 Oblique Twist** on several occasions, try **Level 2 Oblique Twist on the BOSU® Balance Trainer again.**

OBLIQUE SIDE-BENDS

Level 1 - Instruct your client to lie on their side, on the floor, with their right arm bent at ninety degrees and their left arm bent and hand place behind their head. Their knees should be bent and slightly drawn-in toward their torso. Instruct them to lean slightly forward, exhale, and bend to their. Pause. Inhale and return to start. Perform several repetitions on each side and increase as their comfort level and strength dictates. Make sure there is no discomfort on the affected side when leaning on it.

When your client is confident and stable at **Level 1 Oblique Side-bends,** they may progress to **Level 2 Oblique Side-bends on the BOSU® Balance Trainer.**

Level 2 - Instruct your client to lie on their side, over the BOSU® Balance Trainer, with their right arm bent at ninety degrees and their left arm bent and hand place behind their head. Their knees should be bent on the floor and slightly drawn-in toward their torso. Instruct them to lean slightly forward, exhale, and bend to their. Pause. Inhale and return to start. Perform several repetitions on each side and increase as their comfort level and strength dictates. Make sure there is no discomfort on the affected side when leaning on it.

If the client is struggling, please go back to the **Level 1 Oblique Side-bends.** After performing the **Level 1 Oblique Side-bends** on several occasions, try **Level 2 Oblique Side-bends on the BOSU® Balance Trainer** again.

OBLIQUE PRECAUTIONS

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has had lymph nodes removed or irradiated, it is imperative that they begin with minimal repetitions and weight bearing on the affected shoulder, making sure there is no swelling in the affected arm following each session. If there is no sign of swelling they can gradually add more repetitions.

CRUNCHES

Level 1 – Have your client lie supine on the floor with their hands behind their head and elbows out to the side (chest expanded). Instruct your client to start by contracting their abdominal muscles and slightly raising their torso (keeping their chin pointed toward the ceiling and elbows remain out to the sides). Instruct them to pause at the top for 1-2 seconds. It is essential for them to engage their abdominal muscles so that they do not feel discomfort in their lower back. If they experience pain, try reducing the time that they remain in the "contracted" position. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may life the toes of the right and left feet off of the floor maintaining contact with just the heels. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Crunches,** they may progress to **Level 2 Crunches on the BOSU® Balance Trainer.**

Level 2 – Have your client lie supine on the floor with tailbone up against the base of the BOSU® Balance Trainer, and knees bent (lined up over their ankles) shoulder width apart on the floor. Their hands should be placed behind their head and elbows out to the side (chest expanded). Instruct your client to start by contracting their abdominal muscles and slightly raising their torso (keeping their chin pointed toward the ceiling and elbows remain out to the sides). Instruct them to pause at the top for 1-2 seconds. It is essential for them to engage their abdominal muscles so that they do not feel discomfort in their lower back. If they experience pain, try reducing the time that they remain in the "contracted" position. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may life the toes of the right and left feet off of the floor maintaining contact with just the heels. If they are stable with both sets of toes off of the ground, try having them alternate lifting their right and then left foot off of the ground. Progress/regress as needed for the individual's fitness level.

If your client is struggling, or in pain, please have them go back to the **Level 1 Crunches.** After performing the **Level 1 Crunches** on several occasions, pain free, have them try **Level 2 Crunches on the BOSU® Balance Trainer again.**

When the client is confident and stable at **Level 2 Crunches on the BOSU® Balance Trainer,** they may progress to **Level 3 Crunches on the BOSU® Balance Trainer.**

CRUNCH PRECAUTIONS

If your client has undergone a TRAM Flap, please skip this exercise. Although it may seem logical to strengthen these muscles, it will only create more of an imbalance. Remember that their rectus muscle is now in their chest and will contract and relax just as it would in their abdomen.

If your client has osteoporosis in their cervical or lumbar spine, be conservative with cervical and lumbar spinal flexion while having them perform this exercise.

Level 3 – Have your client lie supine on the floor with tailbone up against the base of the BOSU® Balance Trainer, and knees bent (lined up over their ankles) shoulder width apart on the floor. Instruct your client to hold a soft weighted ball between their hands and hold it between their chin and their chest (keeping their cervical spine in neutral and chin pointing toward ceiling). Instruct them to contract their abdominal muscles and slightly raise their torso. Instruct them to pause at the top for 1-2 seconds. It is essential for them to engage their abdominal muscles so that they do not feel discomfort in their lower back. If they experience pain, try reducing the time that they remain in the "contracted" position. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may life the toes of the right and left feet off of the floor maintaining contact with just the heels. If they are stable with both sets of toes off of the ground, try having them alternate lifting their right and then left foot off of the ground. Progress/ regress as needed for the individual's fitness level.

If your client is struggling, or in pain, please have them go back to the **Level 2 Crunches on the BOSU® Balance Trainer.** After performing the **Level 2 Crunches on the BOSU® Balance Trainer** on several occasions, pain free, have them try **Level 3 Crunches on the BOSU® Balance Trainer** again.

OPPOSITE ELBOW/KNEE PRECAUTIONS

If your client has undergone a TRAM Flap, please proceed with caution on this exercise. They may display demonstrable weakness due to loss of the rectus abdominis muscles. Help them to focus on contracting their obliques.

If your client has osteoporosis in their cervical or lumbar spine, be conservative with cervical and lumbar spinal flexion while having them perform this exercise.

Level 2

OPPOSITE ELBOW/KNEE

Level 1 – Have your client lie supine on the floor with their hands behind their head and elbows out to the side (chest expanded). Instruct your client to start by contracting their abdominal muscles and slightly raising their torso (keeping their chin pointed toward the ceiling and elbows remain out to the sides). Instruct them to try and touch their right elbow to their left knee and vice versa. They should pause at the top for 1-2 seconds. It is essential for them to engage their abdominal muscles so that they do not feel discomfort in their lower back. If they experience pain, try reducing the time that they remain in the "contracted" position. Perform several repetitions on each side and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may life the toes of the right and left feet off of the floor maintaining contact with just the heels. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Opposite Elbow/Knee,** they may progress to **Level 2 Opposite Elbow/Knee on the BOSU® Balance Trainer.**

Level 2 – Have your client lie supine on the floor with tailbone up against the base of the BOSU® Balance Trainer, and knees bent (lined up over their ankles) shoulder width apart on the floor. Their hands should be placed behind their head and elbows out to the side (chest expanded). Instruct your client to start by contracting their abdominal muscles and slightly raising their torso (keeping their chin pointed toward the ceiling and elbows remain out to the sides). Instruct them to pause at the top for 1-2 seconds. It is essential for them to engage their abdominal muscles so that they do not feel discomfort in their lower back. If they experience pain, try reducing the time that they remain in the "contracted" position. Perform several repetitions on each side and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may lift the toes of the right and left feet off of the floor maintaining contact with just the heels. If they are stable with both sets of toes off of the ground, try having them alternate lifting their right and then left foot off of the ground. Progress/ regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Opposite Elbow/Knee.** After performing the **Level 1 Opposite Elbow/Knee** on several occasions, pain free, try **Level 2 Opposite Elbow/Knee on the BOSU® Balance Trainer** again.

Level 2

"V" SIT

Level 1 - Have your client sit on the center of the BOSU® Balance Trainer with their arms by their sides; slightly behind their hips. Instruct them to lean back, expand their chest, extend their legs out (and then back in), with their knees bent. Have them engage their abdominal muscles, exhale, and draw their left knee in toward their chest while the right foot maintains contact with the floor. Pause. Instruct them to inhale and allow their upper body and lower body to move away from each other in opposite directions and then repeat on the other leg. Instruct them to only go as far as they can while maintaining control of their core and remaining free of any back pain or discomfort. Perform several repetitions on each side and increase as their comfort level and strength dictates.

When the client is confident and stable at **Level 1 "V" Sit on the BOSU® Balance Trainer,** they may progress to **Level 2 "V Sit" on the BOSU® Balance Trainer.**

Level 2 - Have your client sit on the center of the BOSU® Balance Trainer with their arms extended over their head. Instruct them to lean back, expand their chest, extend their legs out (and then back in) with their knees bent. Have them engage their abdominal muscles, exhale, and draw their knees in toward their chest while bringing their hands (arms) toward their feet. Pause. Inhale and allow their upper body and lower body to move away from each other in opposite directions. Instruct them to only go as far as they can while maintaining control of their core and remaining free of any back pain or discomfort. Perform several repetitions on each side and increase as their comfort level and strength dictates.

If the client is struggling, please go back to **Level 1 "V" Sit on the BOSU® Balance Trainer.** After performing **Level 1 "V" Sit on the BOSU® Balance Trainer** on several occasions, try the **Level 2 "V" Sit on the BOSU® Balance Trainer** again.

Level 1

"V" SIT PRECAUTIONS

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers.

If your client has undergone a TRAM Flap, please skip this exercise. Although it may seem logical to strengthen these muscles, it will only create more of an imbalance. Remember that their rectus muscle is now in their chest and will contract and relax just as it would in their abdomen.

If your client has osteoporosis in their cervical or lumbar spine, be conservative with cervical and lumbar spinal flexion while performing this exercise.

It is inadvisable to remove a contact point with either wrist or forearm due to the amount of added pressure this may put on the affected arm/shoulder.

SQUATS

Level 1 – Instruct your client to stand with feet hip width apart on the floor. Place the back of a chair in front of them and instruct them to hold on to it for balance. Instruct them to bend their knees as much as they can while maintaining stability as well as avoiding any knee pain. Remind them to engage their abdominal muscles, contract their gluteal muscles and push their heels into the floor as they straighten their body back to start. Remind them to always maintain a slight bend in the knees. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the heel of the right foot off of the floor. They may alternate lifting their right and then left heel off of the ground. Progress/regress as needed.

When you are confident and stable at **Level 1 Squats,** you may progress to **Level 2 Squats on the BOSU® Balance Trainer.**

Level 2 – Instruct your client to stand with feet hip width apart on the BOSU® Balance Trainer. Place the back of a chair in front of them (or have them hold your hands or use a body bar) and instruct them to hold on to it for balance. Instruct them to bend their knees as much as they can while maintaining stability as well as avoiding any knee pain. Remind them to engage their abdominal muscles, contract their gluteal muscles and push their heels into the BOSU® Balance Trainer as they straighten their body back to start. They should always maintain a slight bend in the knees. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the BOSU® Balance Trainer by lifting the toes of the right foot off of the dome and performing a one-leg squat. They may alternate lifting their right and then left foot. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 2 Squats on the BOSU® Balance Trainer,** they may progress to **Level 3 Squats on the BOSU Balance Trainer.**

Level 3 – Instruct your client to stand with feet hip width apart on the BOSU® Balance Trainer. Have them raise their arms out to their sides for balance and lift the toes of their right foot off of the dome while slightly bending the left knee. Instruct them to bend their left knee as much as they can while maintaining stability as well as avoiding any knee pain. Remind them to engage their abdominal muscles, contract their gluteal muscles and push their heel into the BOSU® Balance Trainer as they straighten their body back to start. They should always maintain a slight bend in the knees. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them hold a soft weighted ball out in front of them while performing the squat. If they are able to do that and maintain good form, have them move the ball to one side and then the other while tracking it with their eyes. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 2 Squats on the BOSU® Balance Trainer.** After performing the **Level 2 Squats on the BOSU® Balance Trainer** on several occasions, pain free, try **Level 3 Squat s on the BOSU® Balance Trainer** again.

Level 3

SQUAT PRECAUTIONS

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has peripheral neuropathy in their feet, only have them perform the Level 1 exercise.

CEILING PUNCH

This exercise helps to stabilize the shoulder girdle and prevent "winging" of the scapula. This is a fairly common occurrence after an axillary node dissection.

Level 1 – Have your client lie on the floor with their knees are bent. Instruct them to begin with their arms extended toward the ceiling and palms facing each other (no bend in elbows). Have them reach up to the ceiling, elevating shoulders off of the floor without raising their head. This is an isolated movement specifically targeting the shoulder girdle. Pause at the top for 3-5 seconds. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may life the toes of the right and left feet off of the floor maintaining contact with just the heels. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Ceiling Punch,** they may progress to **Level 2 Ceiling Punch on the BOSU® Balance Trainer.**

Level 2 - Position your client on the BOSU® Balance Trainer so that their knees are bent and their head and upper/mid back are supported by the BOSU® Balance Trainer. Instruct them to begin with their arms extended toward the ceiling and palms facing each other (no bend in elbows). Have them reach up to the ceiling, elevating shoulders off of the BOSU® Balance Trainer without raising their head. This is an isolated movement specifically targeting the shoulder girdle. Pause at the top for 3-5 seconds. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may life the toes of the right and left feet off of the floor maintaining contact with just the heels. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to the **Level 1 Ceiling Punch.** After performing the **Level 1 Ceiling Punch** on several occasions, try the **Level 2 Ceiling Punch on the BOSU® Balance Trainer** again.

Level 2

CEILING PUNCH PRECAUTIONS

If your client has undergone a unilateral TRAM Flap (only one side of their rectus abdominis has been sacrificed) they may need minor assistance in lowering themselves back onto the BOSU® Balance Trainer. On the other hand, if it is a bi-lateral Tram Flap, they will NOT be able to roll backwards or subsequently roll themselves back to an upright position without assistance. You may help them with this motion, or instruct them to roll onto their side in order to get "in to" and "out of" the position.

SERRATUS PUSH-UP

Level 1 – Instruct your client to stand with feet hip width apart on the floor (standing on the toes and balls of the feet). Have them place their hands shoulder width apart on the wall with their fingertips at shoulder height. Make sure that they engage their abdominal muscles, bend their elbows, and lean in towards the wall until their nose touches the wall. They will exhale and push themselves off of the wall, but instead of maintaining a slight bend in their elbows they will fully extend their arms and create somewhat of a "cat back" in their spine. Perform several repetitions on each side and increase as their comfort level and strength dictates.

When the client is confident and stable at **Level 1 Serratus Push-up,** they may progress to **Level 2 Serratus Push-up on the BOSU® Balance Trainer.**

Level 2 – Instruct your client to place their hands shoulder width apart on the BOSU® Balance Trainer. Their knees should be bent at approximately one hundred and twenty degrees and their back should be rigid. The "starting" position is what we would consider the "end" position for a normal push-up. Remind your client to engage their abdominal muscles, exhale, and "push" their upper back toward the ceiling (like a cat back). Pause for 2-3 seconds. Inhale and return to starting position. Perform several repetitions on each side and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one foot off of the floor, but maintaining contact with the knee. Next have them lift both feet off of the floor while maintain contact with both knees. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Serratus Push-up.** After performing the **Level 1 Serratus Push-up** on several occasions, pain free, try **Level 2 Serratus Push-up on the BOSU® Balance Trainer** again.

Level 2

SERRATUS PUSH-UP PRECAUTIONS

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has had lymph nodes removed or irradiated, it is imperative that they begin with minimal repetitions and weight bearing on the affected shoulder, making sure there is no swelling in the affected arm following each session. If there is no sign of swelling they can gradually add more repetitions.

WARM-UP/BOUNCING ON THE BOSU®

Level 1 – The beginner should **NOT** do this warm-up without someone there to spot them. The spotter should stand in front of them and hold their hands continuously throughout the warm-up. The client should gently bounce up and down for five minutes, shifting their weight from one foot to the other.

If the client is struggling, please go back to the general warm-up. After performing the general warm-up on several occasions, try **Level 1 warm-up on the BOSU® Balance Trainer** again. When the client is confident and stable at **Level 1,** they may progress to **Level 2 warm-up on the BOSU® Balance Trainer.**

Level 2 - Have your client place the BOSU® Balance Trainer next to something stable (wall, rail, corner, etc.). If using a corner, the client will stand on the BOSU® Balance Trainer and face into the corner. If using a wall or rail, they may place the BOSU® Balance Trainer next to it. In either case, the client should be instructed to hold on for balance. They should gently bounce up and down for five minutes, shifting their weight from one foot to the other.

If the client is struggling, please go back to the **Level 1 warm-up.** After performing the **Level 1 warm-up** on several occasions, try **Level 2 warm-up on the BOSU® Balance Trainer** again. When the client is confident and stable at **Level 2 warm-up,** they may progress to **Level 3 warm-up on the BOSU® Balance Trainer.**

Level 3 – The client wanting to try **Level 3 warm-up on the BOSU® Balance Trainer** should feel confident in their stability and balance and have been successful for a few weeks at **Level 2 warm-up on the BOSU® Balance Trainer.** At this advanced level, they should be able to perform the warm-up on the BOSU® Balance Trainer with no spot and no props.

If the client is struggling, please go back to the **Level 2 warm-up on the BOSU® Balance Trainer**. After performing the **Level 2 warm-up on the BOSU® Balance Trainer** on several occasions, try **Level 3 warm-up on the BOSU® Balance Trainer** again.

LYMPHATIC DRAINAGE ROUTINE (THESE EXERCISES SHOULD BE PERFORMED BY ANYONE WHO HAS HAD LYMPH NODES REMOVED OR IRRADIATED)

MARCHING PRECAUTIONS

The beginner should start by marching in place on the floor and when you and they feel ready, have them stand on the BOSU® Balance Trainer. They should NOT perform the warm-up on the BOSU® Balance Trainer without someone there to spot them!

If your client has peripheral neuropathy in their feet, they can perform an alternate warm up such as a stationary bike, marching in place while seated, using a rowing machine, or simply shift their weight rhythmically from side-to-side on the BOSU® Balance Trainer.

FORWARD NECK FLEXION

Instruct your client to sit upright in the center of the BOSU® Balance Trainer with their arms bent and palms of their hands against their head. Have them engage their abdominal muscles and tilt their chin to their chest; letting the weight of their hands cause a gentle stretch. Have them hold for 15-30 seconds, or as long as they can ***without pain*** (make sure that they are not holding their breath or compensating their form).

NECK STRETCH PRECAUTIONS

If your client has osteoporosis, or has undergone surgery, in their cervical spine, avoid forward neck flexion and lateral neck flexion exercises.
If your client has peripheral neuropathy in their feet, have them perform the exercises standing on the BOSU® only if they are able to remain "pain free" and maintain their center of gravity.

If your client has peripheral neuropathy in their feet, do not have them perform the exercises standing on the BOSU® Balance Trainer; use the floor instead.

LATERAL NECK FLEXION

Instruct your client to sit upright in the center of the BOSU® Balance Trainer with their right arm bent behind their back (if they can't do this, instruct them to let that arm relax at their side). Have them engage their abdominal muscles, place their left hand on the top of their head, and tilt their head towards their left shoulder without allowing their right shoulder to lift up; letting the weight of their hand cause a gentle stretch. Have them hold for 15-30 seconds, or as long as they can ***without pain*** (make sure that they are not holding their breath or compensating their form). Perform this on both sides.

SHOULDER SHRUGS

Level 1 – Instruct your client to stand with feet hip width apart on the floor with their arms hanging by their sides, palms facing their body. Have them exhale and raise their shoulders up towards their ears. Pause for 2-3 seconds and relax back into starting position. Now instruct them to reach down as far as they can (as if trying to slide their hands down the side of their legs toward their knees) pause for 2-3 seconds and relax back into starting position. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the heel of the right foot off of the floor. They may alternate lifting their right and then left heel off of the ground. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable **at Level 1 Shoulder shrugs,** they may progress to **Level 2 Shoulder shrugs on the BOSU® Balance Trainer.**

Level 2 – Instruct your client to stand with their feet hip width apart on the BOSU® Balance Trainer with their arms hanging by their sides, palms facing their body. Have them exhale and raise their shoulders up towards their ears. Pause for 2-3 seconds and relax back into starting position. Now instruct them to reach down as far as they can (as if trying to slide their hands down the side of their legs toward their knees) pause for 2-3 seconds and relax back into starting position. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the dome by lifting the heel of the right foot off of the dome. They may alternate lifting their right and then left heel off of the dome. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Shoulder shrugs.** After performing the **Level 1 Shoulder shrugs** on several occasions, pain free, try **Level 2 Shoulder shrugs on the BOSU® Balance Trainer** again.

Level 2

SHOULDER ROTATIONS

Level 1 – Instruct your client to stand with feet hip width apart on the floor with their arms out to their sides, trying to elevate them to shoulder height (if they can't do this, instruct them to raise them as high as they can without pain). Have them begin with the palms of their hands facing the floor and slowly rotate them up toward the ceiling. Perform several repetitions and increase as their comfort level and strength dictates. Stop at any point that it becomes painful or difficult for them to hold their arms up.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the heel of the right foot off of the floor. They may alternate lifting their right and then left heel off of the ground. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Shoulder rotations,** they may progress to **Level 2 Shoulder rotations on the BOSU® Balance Trainer.**

Level 2 – Instruct your client to stand with feet hip width apart on the BOSU® Balance Trainer with their arms out to their sides, trying to elevate them to shoulder height (if they can't do this, instruct them to raise them as high as they can without pain). Have them begin with the palms of their hands facing the floor and slowly rotate them up toward the ceiling. Perform several repetitions and increase as their comfort level and strength dictates. Stop at any point that it becomes painful or difficult for them to hold their arms up.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the dome by lifting the heel of the right foot off of the dome. They may alternate lifting their right and then left heel off of the dome. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Shoulder rotations.** After performing the **Level 1 Shoulder rotations** on several occasions, pain free, try **Level 2 Shoulder rotations on the BOSU® Balance Trainer** again.

Level 2

SHOULDER BLADE SQUEEZE

Level 1 - Instruct your client to stand with feet hip width apart on the floor. Have them bend both elbows and raise them out to their sides. Instruct them to retract their shoulder blades (think about squeezing a tennis ball between them), and push their elbows back as if they were trying to get them to touch each other. Pause for 3-5 seconds. Perform several repetitions and increase as their comfort level and strength dictates. ***If they have high blood pressure, only hold the contraction for one second and make sure that they do not hold their breath.***

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the heel of the right foot off of the floor. They may alternate lifting their right and then left heel off of the ground. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Shoulder blade squeeze,** they may progress to **Level 2 Shoulder blade squeeze on the BOSU® Balance Trainer.**

Level 2 - Instruct your client to stand with feet hip width apart on the BOSU ® Balance Trainer. Have them bend both elbows and raise them out to their sides. Instruct them to retract their shoulder blades (think about squeezing a tennis ball between them), and push their elbows back as if they were trying to get them to touch each other. Pause for 3-5 seconds. Perform several repetitions and increase as their comfort level and strength dictates. ***If they have high blood pressure, only hold the contraction for one second and make sure that they do not hold their breath.***

For the client who is ready for a greater balance challenge, have them try to minimize contact with the dome by lifting the heel of the right foot off of the dome. They may alternate lifting their right and then left heel off of the dome. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Shoulder blade squeeze.** After performing the **Level 1 Shoulder blade squeeze** on several occasions, pain free, try **Level 2 Shoulder blade squeeze on the BOSU® Balance Trainer** again.

Level 2

CHEST SQUEEZE

Level 1 - Instruct your client to stand with feet hip width apart on the floor. Have them place the palms of their hands together in "prayer" position. Exhale and press palms together while contracting chest muscles and squeezing under arm pits. Pause for 3-5 seconds. Perform several repetitions and increase as their comfort level and strength dictates. ***If they have high blood pressure, only hold the contraction for one second and make sure that they do not hold their breath.***

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the heel of the right foot off of the floor. They may alternate lifting their right and then left heel off of the ground. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Chest squeeze,** they may progress to **Level 2 Chest squeeze on the BOSU® Balance Trainer.**

Level 2 - Instruct your client to stand with feet hip width apart on the BOSU® Balance Trainer. Have them place the palms of their hands together in "prayer" position. Exhale and press palms together while contracting chest muscles and squeezing under arm pits. Pause for 3-5 seconds. Perform several repetitions and increase as their comfort level and strength dictates. ***If they have high blood pressure, only hold the contraction for one second and make sure that they do not hold their breath.***

For the client who is ready for a greater balance challenge, have them try to minimize contact with the dome by lifting the heel of the right foot off of the dome. They may alternate lifting their right and then left heel off of the dome. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Chest squeeze,** they may progress to **Level 2 Chest squeeze on the BOSU® Balance Trainer.**

Level 2

FIST CLENCH

Instruct your client to sit upright in the center of the BOSU® Balance Trainer with their arms elevated overhead. Have them engage their abdominal muscles and open and close their fists; squeezing gently after they close them. Perform several repetitions and increase as their comfort level and strength dictates. They may perform this exercise between sets of other exercises as it will help to promote lymphatic drainage.

STRENGTH (BEGIN THESE EXERCISES WHEN YOUR CLIENT CAN PERFORM THE RANGE OF MOTION EXERCISES [ROM] WITH GOOD FORM AND CLOSE TO FULL ROM. DO NOT HAVE THEM PERFORM THESE EXERCISES IF THEY CAN'T MOVE THROUGH THE ROM WITH GOOD FORM AND FLEXIBILITY AS THAT WILL ONLY SERVE TO LIMIT THEIR ROM FURTHER). THESE EXERCISES SUPPLEMENT THE OTHER STRENGTH TRAINING EXERCISES THROUGHOUT THE BOOK.

CHEST FLY PRECAUTIONS

If your client has expanders, wait until the expanders have been removed before having them perform any exercises that work the chest eccentrically or concentrically.

If your client has expanders or breast implants, you will want to have them begin with limited ROM. It is rare, but possible, that the implants will move out of their "pocket," and need surgical correction.

If your client has undergone a unilateral TRAM Flap (only one side of their rectus abdominis has been sacrificed) they may need minor assistance in lowering themselves back onto the BOSU® Balance Trainer. On the other hand, if it is a bi-lateral Tram Flap, they will NOT be able to roll backwards or subsequently roll themselves back to an upright position without assistance. You may help them with this motion, or instruct them to roll onto their side in order to get "in to" and "out of" the position.

There may come a point at which your client can perform this stretch and not feel a "stretch" any longer. While this is a positive outcome, do not take your client's newly discovered "flexibility' for granted. More often than not, without continued practice, the client will gradually lose the newly acquired flexibility and/or ROM. Therefore it is essential, that they continue with this stretch at least periodically, into perpetuity.

CHEST FLY

Level 1 - Begin by having your client sit at the base of the BOSU® Balance Trainer. Instruct them to carefully lower themselves back until their head and mid back are supported by the BOSU® Balance Trainer. ***If they have undergone a TRAM flap, they will want to roll sideways rather than "backwards" onto the BOSU® Balance Trainer.*** Have them start by raising their arms straight up towards the ceiling with their palms facing each other. Instruct them to bend their elbows slightly; as if hugging a barrel. They should allow their arms to slowly lower outward and toward the floor while maintaining a slight bend in their elbows. Perform several repetitions and increase as their comfort level and strength dictates.

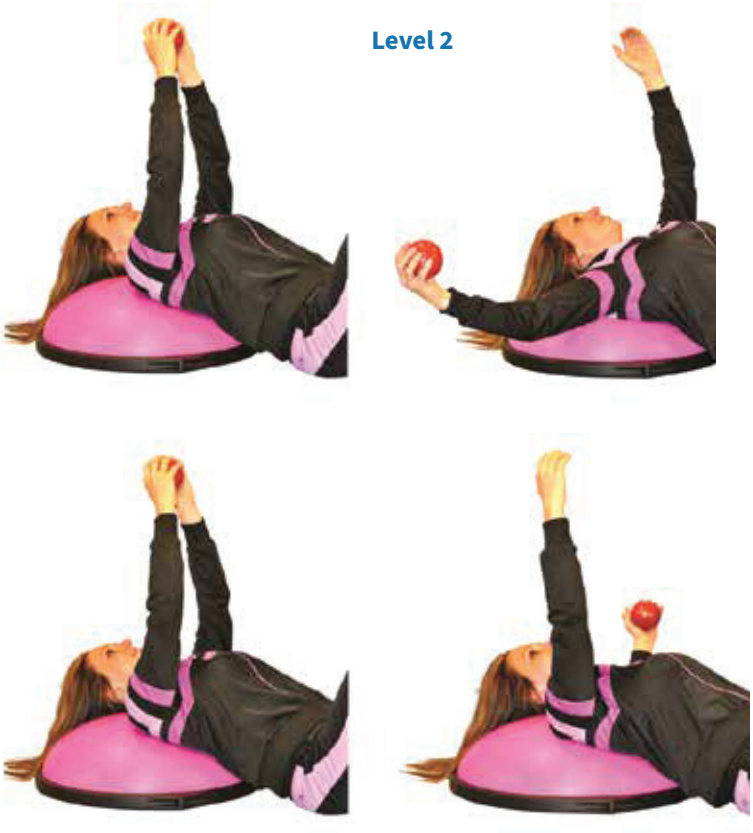
For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one heel off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Alternate sides. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Chest fly,** they may progress to **Level 2 Chest fly on the BOSU® Balance Trainer.**

Level 2 - Begin by having your client sit at the base of the BOSU® Balance Trainer. Instruct them to carefully lower themselves back until their head and mid back are supported by the BOSU® Balance Trainer. ***If they have undergone a TRAM flap, they will want to roll sideways rather than "backwards" onto the BOSU® Balance Trainer.*** Carefully hand your client a 1-2 lb. exercise ball and instruct them to raise it above their chest. They will contract their abdominal muscles and, holding the ball in their right hand only, have them slowly begin to lower their right arm out to the side. Make sure that they maintain a slight bend in their right elbow and keep their arm rounded (as if they were hugging a barrel). Remind them to contract the muscles by their armpit, exhale, and bring their right arm back to starting position. Transfer the ball to the left side and repeat on the left. Perform several repetitions on each side and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one heel off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. They may also try tracking the ball with their eyes as they alternate sides. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Chest fly.** After performing the **Level 1 Chest fly** on several occasions, pain free, try **Level 2 Chest fly on the BOSU® Balance Trainer** again. When the client is confident and can perform the **Level 2 Chest fly on the BOSU® Balance Trainer** pain-free, they may progress to **Level 3 Chest fly on the BOSU® Balance Trainer.**



Level 2

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one heel off of the floor, but maintaining contact with the toes. Progress/regress as needed for the individual's fitness level.

Level 3 - Begin by having your client sit at the base of the BOSU® Balance Trainer. Instruct them to carefully lower themselves back until their head and mid back are supported by the BOSU® Balance Trainer. ***If they have undergone a TRAM flap, they will want to roll sideways rather than "backwards" onto the BOSU® Balance Trainer.*** Carefully hand your client a 1-2 lb. weight in each hand and instruct them to raise them above their chest. They will contract their abdominal muscles and slowly begin to lower their arms out to the side. Make sure that they maintain a slight bend in their elbows and keep their arms rounded (as if they were hugging a barrel). Remind them to contract the muscles by their armpits, exhale, and bring their arms back to starting position. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting one heel off of the floor, but maintaining contact with the toes. Next have them try to eliminate all contact with one foot. Alternate sides. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 2 Chest fly on the BOSU® Balance Trainer.** After performing the **Level 2 Chest fly on the BOSU® Balance Trainer** on several occasions, pain free, try **Level 3 Chest fly on the BOSU® Balance Trainer** again.

Level 2

PUSH-UP

Level 1 – Instruct your client to stand with feet hip width apart on the floor (standing on the toes and balls of the feet). Have them place their hands shoulder width apart on the wall with their fingertips at shoulder height. Make sure that they engage their abdominal muscles, bend their elbows, and lean in towards the wall until their nose touches the wall. They will exhale and push themselves off of the wall, maintaining a slight bend in their elbows. Perform several repetitions and increase as their comfort level and strength dictates.

When the client is confident and stable at **Level 1 Push-up,** they may progress to **Level 2 Push-up on the BOSU® Balance Trainer.**

Level 2 – Instruct your client to place their hands shoulder width apart on the BOSU® Balance Trainer. Their knees should be bent at approximately one hundred and twenty degrees and their back should be rigid. The "starting" position is what we would consider the "end" position for a normal push-up. They will inhale and lower themselves toward the BOSU® Balance Trainer maintaining a slight bend in their elbows. Next, they will exhale and push themselves off of the BOSU® Balance Trainer without locking their elbows out at the end of the motion. Perform several and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the right foot off of the floor and holding that position for several seconds. Have them alternate lifting their right and then left foot off of the ground. When they are confident and stable, have them try lifting both feet off of the ground, while remaining in contact with their knees. Progress/ regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Push-up.** After performing the **Level 1 Push-up** on several occasions, pain free, try **Level 2 Push-up on the BOSU® Balance Trainer** again. When the client is confident and stable at **Level 2 Push-up on the BOSU® Balance Trainer,** they may progress to **Level 3 Push-up on the BOSU® Balance Trainer.**

Level 2

PUSH-UP PRECAUTIONS

If your client has expanders, wait until the expanders have been removed before having them perform any exercises that work the chest eccentrically or concentrically.

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has had lymph nodes removed or irradiated, it is imperative that they begin with minimal repetitions and weight bearing on the affected shoulder, making sure there is no swelling in the affected arm following each session. If there is no sign of swelling they can gradually add more repetitions.

Level 3

Level 3 – Instruct your client to place their hands shoulder width apart on the floor and walk their feet back onto the BOSU® Balance Trainer (making sure that their ankles are lined up over their toes). Their back should be rigid and their abdominal muscles taught. They will inhale and lower themselves toward the floor maintaining a slight bend in their elbows. Next, they will exhale and push themselves off of the floor without locking their elbows out at the end of the motion. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the right foot off of the dome and holding that position for several seconds. Have them alternate lifting their right and then left foot off of the dome. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to **2 Push-up on the BOSU® Balance Trainer.** **Level 2 Push-up on the BOSU® Balance Trainer** occasions, pain free, try **Level 3 Push-up on the BOSU® Balance Trainer** again.

SQUATS

Level 1 – Instruct your client to stand with feet hip width apart on the floor. Place the back of a chair in front of them and instruct them to hold on to it for balance. Instruct them to bend their knees as much as they can while maintaining stability as well as avoiding any knee pain. Remind them to engage their abdominal muscles, contract their gluteal muscles and push their heels into the floor as they straighten their body back to start. Remind them to always maintain a slight bend in the knees. Perform several repetitions on each side and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may alternate lifting their right and then left toes off of the ground. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Squats,** they may progress to **Level 2 Squats.**

Level 2 - Instruct your client to stand with feet hip width apart on the floor. Have them bend their knees as much as they can while maintaining stability as well as avoiding any knee pain. They should hold their arms out in front of them, parallel to the floor, to help them with balance. Remind them to engage their abdominal muscles, contract their gluteal muscles and push their heels into the floor as they straighten their body back to start. Remind them to always maintain a slight bend in the knees. Perform several repetitions on each side and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may alternate lifting their right and then left toes off of the ground. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to **Level 1 Squats.** After performing the **Level 1 Squats** on several occasions, try **Level 2 Squat**s again. When the client is confident and stable at Level 2 Squats, they may progress to **Level 3 Squats on the BOSU® Balance Trainer.**

Level 3 – Instruct your client to stand with their right foot on the floor and left foot in the center of the BOSU® Balance Trainer. Both feet should be pointing forward. Have them bend their knees as much as they can while maintaining stability as well as avoiding any knee pain. They should hold their arms out in front of them, parallel to the floor, to help them with balance. Remind them to engage their abdominal muscles, contract their gluteal muscles and push their heels into the floor and BOSU® Balance Trainer as they straighten their body back to start. Remind them to always maintain a slight bend in the knees. Perform several repetitions on each side and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them hold their arms straight out in front of them, palms touching. After they lower themselves toward the floor, have them rotate their arms to the left and then right, and back to center prior to coming out of the squat Your client can add a weighted ball as tolerated. You can also have them track the movement of their arms with their eyes. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to **Level 2 Squats.** After performing the **Level 2 Squats** on several occasions, try **Level 3 Squats on the BOSU® Balance Trainer again.**

Level 3

SQUAT PRECAUTIONS

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has peripheral neuropathy in their feet, only have them perform the Level 1 exercise.

SQUATS WITH HAMMER CURLS

Level 1 – Instruct your client to stand with feet hip width apart on the floor. Give them a 1-2 pound weight in each hand and have them start with their arms by their sides, palms facing their body. Instruct them to bend their knees (as much as they can while maintaining stability as well as avoiding any knee pain) and simultaneously bend their elbows, raising the weights toward their shoulders (elbows need to remain locked at sides). Remind them to engage their abdominal muscles, contract their gluteal muscles and push their heels into the floor as they straighten their body, and slowly lower their arms back to start. Remind them to always maintain a slight bend in the knees. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the heel of the right foot off of the floor. They may alternate lifting their right and then left heel off of the floor. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Squats with hammer curls,** they may progress to **Level 2 Squats with hammer curls on the BOSU® Balance Trainer.**

Level 2 – Instruct your client to stand with feet hip width apart on the BOSU® Balance Trainer. Give them a 1-2 pound weight in each hand and have them start with their arms by their sides, palms facing their body. Instruct them to bend their knees (as much as they can while maintaining stability as well as avoiding any knee pain) and simultaneously bend their elbows, raising the weights toward their shoulders (elbows need to remain locked at sides). Remind them to engage their abdominal muscles, contract their gluteal muscles and push their heels into the floor as they straighten their body, and slowly lower their arms back to start. Remind them to always maintain a slight bend in the knees. Make sure to "spot" your client at all times. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the dome by lifting the heel of the right foot off of the dome. They may alternate lifting their right and then left heel off of the dome. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Squats with hammer curls.** After performing the **Level 1 Squats with hammer curls** on several occasions, pain free, try **Level 2 Squats with hammer curls on the BOSU® Balance Trainer** again.

Level 2

PLÉA SQUATS WITH ANGLED CURLS

Level 1 – Instruct your client to stand in a "plea" stance on the floor. Both feet should be angled toward the sides with the knees lined-up over the heels. Hand your client a 1-2 pound weight in each hand and have them begin with their arms by their sides (but turned out slightly) and palms facing away from their body. Instruct them to bend their knees (as much as they can while maintaining stability as well as avoiding any knee pain) and simultaneously bend their elbows-raising the weights toward their shoulders (elbows need to remain locked at sides). Remind them to engage their abdominal muscles, contract their gluteal muscles and push their heels into the floor as they straighten their body, and slowly lower their arms back to start. Remind them to always maintain a slight bend in the knees. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the heel of the right foot off of the floor. They may alternate lifting their right and then left heel off of the floor. Progress/ regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Plea squats with angled curls,** they may progress to **Level 2 Plea squats with angled curls on the BOSU® Balance Trainer.**

Level 2 – Instruct your client to stand in a "plea" stance with their right foot on the floor and the left foot on the BOSU® Balance Trainer. Both feet should be angled toward the sides with the knees lined-up over the heels. Hand your client a 1-2 pound weight in each hand and have them begin with their arms by their sides (but turned out slightly) and palms facing away from their body. Instruct them to bend their knees (as much as they can while maintaining stability as well as avoiding any knee pain) and simultaneously bend their elbows-raising the weights toward their shoulders (elbows need to remain locked at sides). Remind them to engage their abdominal muscles, contract their gluteal muscles and push their heels into the floor as they straighten their body, and slowly lower their arms back to start. Remind them to always maintain a slight bend in the knees. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the heel of the right foot off of the floor. They may alternate lifting their right and then left heel off of the floor. Progress/ regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Plea squats with angled curls.** After performing the **Level 1 Plea squats with angled curls** on several occasions, pain free, try **Level 2 Plea squats with angled curls on the BOSU® Balance Trainer** again.

Level 2

Triceps Extension Precautions

If your client has osteoporosis in their lumbar spine, be conservative with spinal flexion while having them perform this exercise.

If your client has expanders or breast implants, you will want to have them begin with limited ROM. It is rare, but possible, that the implants will move out of their "pocket," and need surgical correction.

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has undergone any type of mastectomy or radiation, they may struggle with scar tissue/adhesions across the chest wall. If they are unable to raise their arms back, they should not perform this exercise and they should continue to work on shoulder extension on pages 141.

If your client has peripheral neuropathy in their feet, only have them perform the Level 1 exercise.

TRICEPS EXTENSIONS

Level 1 – Instruct your client to stand with feet hip width apart on the floor. Give them a 1-2 pound weight in each hand and have them start with their arms by their sides, palms facing their body. Have them bend forward or "hinge" at their waist, retract their shoulder blades and raise their arms up so that they are at a ninety degree angle with their hands slightly in front of their hips. Instruct them to exhale and extend their arms back until they are almost at one 180°. Pause 1-2 seconds. Inhale and slowly return to starting position. Remind them to always maintain a slight bend in the knees. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the heel of the right foot off of the floor. They may alternate lifting their right and then left heel off of the floor. Progress/ regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Triceps Extensions,** they may progress to **Level 2 Triceps Extensions on the BOSU® Balance Trainer.**

Level 2 – Instruct your client to stand with feet hip width apart on the BOSU® Balance Trainer. Give them a 1-2 pound weight in each hand and have them start with their arms by their sides, palms facing their body. Have them bend forward or "hinge" at their waist, retract their shoulder blades and raise their arms up so that they are at a ninety degree angle with their hands slightly in front of their hips. Instruct them to exhale and extend their arms back until they are almost at one 180°. Pause 1-2 seconds. Inhale and slowly return to starting position. Remind them to always maintain a slight bend in the knees. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the dome by lifting the heel of the right foot off of the dome. They may alternate lifting their right and then left heel off of the dome. Progress/regress as needed for the individual's fitness level.

If the client is struggling, or in pain, please go back to the **Level 1 Triceps Extensions.** After performing the **Level 1 Triceps Extensions** on several occasions, pain free, try **Level 2 Triceps Extensions on the BOSU® Balance Trainer** again.

Level 2

TRICEPS SKULL CRUSHERS

Level 1 – Have your client lie supine on the floor with their knees bent (lined up over their ankles) shoulder width apart on the floor. With a 1-2 pound weight in each hand have them begin by raising both arms straight over their chest with their palms facing each other. With their elbows pointing toward the ceiling, instruct them to slowly and carefully bend their elbows so that the weights come down right next to their ears on each side. Have them exhale and extend their arms up until they are almost at 180°. Inhale and return to start. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may also lift the toes of the right and left feet off of the floor while maintaining contact with just the heels. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Triceps Extensions,** they may progress to **Level 2 Triceps Extension on the BOSU® Balance Trainer.**

Level 2 – Have your client lie supine on the floor with their tailbone up against the base of the BOSU® Balance Trainer, and knees bent (lined up over their ankles) shoulder width apart on the floor. With a 1-2 pound weight in each hand have them begin by raising both arms straight over their chest with their palms facing each other. With their elbows pointing toward the ceiling, instruct them to slowly and carefully bend their elbows so that the weights come down right next to their ears on each side. Have them exhale and extend their arms up until they are almost at 180°. Inhale and return to start. Perform several repetitions and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them try to minimize contact with the floor by lifting the toes of the right foot off of the floor. They may also lift the toes of the right and left feet off of the floor while maintaining contact with just the heels. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to the **Level 1 Triceps Extensions.** After performing the **Level 1 Triceps Extension** on several occasions, try the **Level 2 Triceps Extension on the BOSU® Balance Trainer** again.

SKULL CRUSHER PRECAUTIONS

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers.

CLAMS

Level 1 - Instruct your client to lie on their side on the floor with their right arm bent and placed behind their head (they may use a pillow or bolster to relieve pressure on the shoulder). Their left arm can rest on their stomach. Their knees should be bent on the floor and slightly drawn-in toward their torso. While keeping their feet in contact with one another, have them contract their gluteal muscles and rotate their left leg outwardly. Pause. Inhale and return to start. Perform several repetitions on each side and increase as their comfort level and strength dictates.

When the client is confident and stable at **Level 1 Fire Hydrants,** they may progress to **Level 2 Fire Hydrants on the BOSU® Balance Trainer.**

Level 2 - Instruct your client to lie on their side, over the BOSU® Balance Trainer, with their right arm bent and placed behind their head. Their knees should be bent on the floor and slightly drawn-in toward their torso. While keeping their feet in contact with one another, have them contract their gluteal muscles and rotate their left leg outwardly. Pause. Inhale and return to start. Perform several repetitions on each side and increase as their comfort level and strength dictates.

If the client is struggling, please go back to the **Level 1 Fire Hydrants.** After performing the **Level 1 Fire Hydrants** on several occasions, try the **Level 2 Fire Hydrants on the BOSU® Balance Trainer** again.

Level 2

LEG RAISES

Level 1 - Instruct your client to lie on their side on the floor with their right arm bent and placed behind their head (they may use a pillow or bolster to relieve pressure on the shoulder). Have them place their left arm in front of them for support. Their bottom knee should be bent on the floor. Instruct them to tilt their hips slightly forward and straighten their top (left) leg. Have them contract their gluteal muscles, push their leg slightly backward, and raise it towards the ceiling. Remind them to keep their abdominal muscles contracted and don't allow their back to arch. Pause. Inhale and return to start. Perform several repetitions on each side and increase as their comfort level and strength dictates.

When the client is confident and stable at **Level 1 Leg Raises,** they may progress to **Level 2 Leg Raises on the BOSU® Balance Trainer.**

Level 2 - Instruct your client to lie on their side, over the BOSU® Balance Trainer, with their right arm bent and placed behind their head (they may use a pillow or bolster to relieve pressure on the shoulder). Have them place their left arm in front of them for support. Their bottom knee should be bent on the floor. Instruct them to tilt their hips slightly forward and straighten their top (left) leg. Have them contract their gluteal muscles, push their leg slightly backward, and raise it towards the ceiling. Remind them to keep their abdominal muscles contracted and don't allow their back to arch. Pause. Inhale and return to start. Perform several repetitions on each side and increase as their comfort level and strength dictates.

If the client is struggling, please go back to the **Level 1 Leg Raises.** After performing the **Level 1 Leg Raises** on several occasions, try the **Level 2 Leg Raises on the BOSU® Balance Trainer** again.

Level 2

LUNGES

Level 1 - Position your client so that their left foot is on the floor with their left knee aligned over the ankle. Instruct them to slide their right leg backward into a lunge position. Have them tilt their right hip slightly forward and contract their gluteal muscle. They will contract their abdominal muscles, inhale, and begin to bend their right knee and lower themselves toward the floor. They should only go as far as they can without causing any knee pain. Remind them to continue to engage their abdominal muscles throughout the motion. Perform several repetitions on each side and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them hold their arms straight out in front of them, palms touching. After they lower themselves toward the floor, have them rotate their arms to the left and then right, and back to center prior to coming out of the lunge. You can add a weighted ball as tolerated. Progress/regress as needed for the individual's fitness level.

When the client is confident and stable at **Level 1 Lunge,** they may progress to **Level 2 Lunge** on the **BOSU® Balance Trainer.**

Level 2 – Position your client so that their left foot is placed in the center of the BOSU® Balance Trainer with their left knee aligned over the ankle. Instruct them to slide their right leg backward into a lunge position. Have them tilt their right hip slightly forward and contract their gluteal muscle. They will contract their abdominal muscles, inhale, and begin to bend their right knee and lower themselves toward the floor. They should only go as far as they can without causing any knee pain. Remind them to continue to engage their abdominal muscles throughout the motion. Perform several repetitions on each side and increase as their comfort level and strength dictates.

For the client who is ready for a greater balance challenge, have them hold their arms straight out in front of them, palms touching. After they lower themselves toward the floor, have them rotate their arms to the left and then right, and back to center prior to coming out of the lunge. You can add a weighted ball as tolerated. You can also have them track the movement of their arms with their eyes. Progress/regress as needed for the individual's fitness level.

If the client is struggling, please go back to **Level 1 Lunge.** After performing the **Level 1 Lunge** on several occasions, try **Level 2 Lunge on the BOSU® Balance Trainer** again.

Level 2

LUNGE PRECAUTIONS

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has peripheral neuropathy in their feet, only have them perform the Level 1 exercise.

ABDUCTION

Level 1 – Instruct your client to stand with feet hip width apart on the floor. Both feet should be pointing forward. Place the back of a chair in front of them and instruct them to hold on to it for balance. Have them bend their knees as much as they can while maintaining stability as well as avoiding any knee pain. Instruct them to exhale, straighten their left leg (don't lock out the knee), and raise their right leg out to the side (make sure their hip does not rotate and their toes remain pointing forward). Pause, inhale, and return to start. Encourage them not to touch the floor with their right foot unless they absolutely have to for balance. Perform several repetitions on each side and increase as their comfort level and strength dictates.

When the client is confident and stable at **Level 1 Abduction,** they may progress to **Level 2 Abduction.**

Level 2 - Instruct your client to stand with feet hip width apart on the floor. Both feet should be pointing forward. Have them bend their knees as much as they can while maintaining stability as well as avoiding any knee pain. Their arms will hang slightly bent by their sides with palms facing inward. Have them exhale, straighten their left leg (don't lock out the knee), raise their right leg out to the side (make sure their hip does not rotate and their toes remain pointing forward), and simultaneously raise their arms out to the side (like wings). Pause, inhale, and return to start. Encourage them not to touch the floor with their right foot unless they absolutely have to for balance. Perform several repetitions on each side and increase as their comfort level and strength dictates.

If the client is struggling, please go back to **Level 1 Abduction.** After performing **Level 1 Abduction** on several occasions, try **Level 2 Abduction** again. When the client is confident and stable at **Level 2 Abduction,** they may progress to **Level 3 Abduction on the BOSU® Balance Trainer.**

Level 3 – Instruct your client to stand with their right foot on the floor and left foot in the center of the BOSU® Balance Trainer. Both feet should be pointing forward. Their arms will hang slightly bent by their sides with palms facing inward. Have them exhale, straighten their left leg (don't lock out the knee), raise their right leg out to the side (make sure their hip does not rotate and their toes remain pointing forward), and simultaneously raise their arms out to the side (like wings). Pause, inhale, and return to start. Encourage them not to touch the floor with their right foot unless they absolutely have to for balance. Perform several repetitions on each side and increase as their comfort level and strength dictates.

If the client is struggling, please go back to **Level 2 Abduction.** After performing **Level 2 Abduction** on several occasions, try **Level 3 Abduction on the BOSU® Balance Trainer** again.

Level 2

ABDUCTION PRECAUTIONS

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has peripheral neuropathy in their feet, only have them perform the Level 1 exercise.

COOL DOWN STRETCHES

CAT BACK

Level 1 – Instruct your client to position themselves on "all fours" on the floor. Make sure their shoulders and knees are roughly shoulder/hip width apart. Their shoulders should be lined up over their wrists (fingers pointing forward) and their hips lined up over their knees. Arms should be out far enough so that your back is flat like a table top. Have them begin with a flat back (like a table top), draw their abdominal muscles in toward their spine, and push their spine up towards ceiling (like a cat). Pause, inhale, and return to start. Perform several repetitions and transition to Child's pose.

When the client is confident and stable at **Level 1 Cat Back,** they may progress to **Level 2 Cat Back on the BOSU® Balance Trainer.**

Level 2 – Instruct your client to position themselves on "all fours" with their knees on the BOSU® Balance Trainer. Make sure their shoulders and knees are roughly shoulder/hip width apart. Their shoulders should be lined up over their wrists (fingers pointing forward) and their hips lined up over their knees. Arms should be out far enough so that your back is flat like a table top. Have them begin with a flat back (like a table top), draw their abdominal muscles in toward their spine, and push their spine up towards ceiling (like a cat). Pause, inhale, and return to start. Perform several repetitions and transition to Child's pose.

If the client is struggling, please go back to **Level 1 Cat Back.** After performing **Level 1 Cat Back** on several occasions, try **Level 2 Cat Back on the BOSU® Balance Trainer** again.

LYMPHEDEMA PRECAUTIONS

If your client has had lymph nodes removed or irradiated, it is imperative that they begin with minimal repetitions and little to no resistance, making sure there is no swelling in the affected arm following each session. If there is no sign of swelling, they can gradually add more repetitions.

Level 2

CAT BACK PRECAUTIONS

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises.

If your client has issues with wrist flexion, you can use a bolster and have them position themselves on their elbow, or you can position two dumbbells in front of them that they can use to take the pressure off of their wrists.

CHILD'S POSE

Begin in cat back position as shown above (either on the floor or on the BOSU® Balance Trainer. Instruct your client to sit back on their heels (if this hurts their knees, don't have them sit back as far). Tell them to take a few deep breaths and "walk" their fingers out in front of them as far as they can. Make sure that they ***stop*** when they feel a gentle stretching sensation. Hold for 15-30 seconds, or as long as they can ***without pain*** (make sure that they are not holding your breath).

CHILD'S POSE PRECAUTIONS

If your client has osteoporosis in their lumbar spine, be conservative with spinal flexion while having them perform this exercise.

BACK EXTENSION

Level 1 – Have your client lie prone with their torso centered on the BOSU® Balance Trainer (minimize the amount of contact they have with their chest). Once in position, they should bend their arms and place their hands behind their head. Have them contract both their abdominal and gluteal muscles, exhale and lift their chest off of the BOSU® Balance Trainer (make sure they don't arch their back as this may strain their low back and may cause unnecessary pain). Hold for 3-5 seconds, or as long as they can ***without pain*** (make sure that they are not holding their breath or compensating their form). Perform several repetitions and increase as their comfort level and strength dictates.

BACK EXTENSION PRECAUTIONS

If your client has osteoporosis in their lumbar spine, be conservative with spinal extension while having them perform this exercise.

If your client has expanders or breast implants, make sure they are positioned in such a way that there is minimal pressure put on their chest; finding a comfortable spot on the BOSU® Balance Trainer.

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises. If they have not completely healed from surgery and/or are experiencing any discomfort or pain at the incision site, stop performing this exercise and come back to it at a later date.

SUPERWOMAN II

Level 1 – Have your client lie prone with their torso centered on the BOSU® Balance Trainer (minimize the amount of contact they have with their chest). Once in position, they should raise their arms overhead. Have them contract both their abdominal and gluteal muscles, exhale and simultaneously lift their chest off of the BOSU® Balance Trainer (make sure they don't arch their back as this may strain their low back and may cause unnecessary pain) and lift their right foot off of the floor. Hold for 3-5 seconds, or as long as they can ***without pain*** (make sure that they are not holding their breath or compensating their form). Perform several repetitions and increase as their comfort level and strength dictates.

SUPERWOMAN II PRECAUTIONS

If your client has osteoporosis in their lumbar spine, be conservative with spinal extension while having them perform this exercise.

If your client has expanders or breast implants, make sure they are positioned in such a way that there is minimal pressure put on their chest; finding a comfortable spot on the BOSU® Balance Trainer.

If your client has undergone a LAT Flap, they will have noticeable weakness and instability in the affected shoulder. Teach them how to retract their shoulders prior to initiating the movement. This will help them to contract their rhomboids and other scapular stabilizers. Keep in mind that one, or both, of their latissimus muscles are now in their chest wall. Because they are still "attached," they may feel a contraction in their chest when back exercises are performed. This is one of the many reasons why it is important to focus on the smaller scapular stabilizers of the back.

If your client has undergone a TRAM Flap, this is a fantastic opportunity to educate them on how to engage their spinal stabilizers and core musculature. Watch for excessive arching in the lower back. If they complain of low back pain, more attention should be paid to core "education" and exercises. If they have not completely healed from surgery and/or are experiencing any discomfort or pain at the incision site, stop performing this exercise and come back to it at a later date.

If your client has undergone an axillary node dissection or radiation to their chest wall, they may not be able to extend their arms completely. Please go back to pages 140-142.

FORMS

HEALTH HISTORY QUESTIONNAIRE

Last Name _____ First Name _____

Home Phone _____ Work Phone _____

Email Address _____

Home Address _____

In Case of Emergency Contact _____

Emergency Contact Phone # _____

Personal Physician _____

Physician's Phone # _____

Date of Birth _____ Age _____

The testing and evaluation process provides information on your current level of fitness, and for the development of an individual exercise program. The fitness assessment emphasizes cardiovascular and muscular fitness as well as flexibility, range of motion, core strength, and balance. In order to get a complete and appropriate individual assessment, it is imperative that you fill out this form completely and that you don't leave out any information that could influence your individual program.

Family history – check if any of your immediate family has had:

Heart Disease: ☐ Mom ☐ Dad ☐ Grandfather ☐ Grandmother ☐ Brother/sister

Stroke: ☐ Mom ☐ Dad ☐ Grandfather ☐ Grandmother ☐ Brother/sister

Diabetes: ☐ Mom ☐ Dad ☐ Grandfather ☐ Grandmother ☐ Brother/sister

High blood pressure: ☐ Mom ☐ Dad ☐ Grandfather ☐ Grandmother ☐ Brother/sister

High cholesterol: ☐ Mom ☐ Dad ☐ Grandfather ☐ Grandmother ☐ Brother/sister

Other conditions/comments:

_____

_____

_____

If there was a documented case of heart disease, please check the age category when they first knew.

☐ Under 50 years of age

☐ Between 50-65 years of age

☐ Over 65 years of age

Have any relatives died suddenly, without prior warning or knowledge of heart disease?

☐ Yes ☐ No

If yes, who?_____ Age at time of death?_____

Personal history – check if you have had:

AIDS ☐ Anemia ☐ Arthritis ☐ Asthma ☐ Bronchitis or Emphysema ☐

Cancer ☐

If so, what kind? _____

Surgery (Type and Date) _____

Treatment (Type and Date)_____

Diabetes ☐ Epilepsy ☐ Gout ☐ Heart disease ☐

Heart murmur, skipped, or rapid beats ☐ High blood pressure ☐

High cholesterol ☐ Kidney disease ☐ Lung Disease ☐

Phlebitis ☐ Rheumatic Fever ☐ Stroke ☐ Thyroid problems ☐

Orthopedic injuries or chronic pain:

Neck ☐ L shoulder ☐ R shoulder ☐ Cervical spine ☐

Thoracic spine ☐ Lumbar spine ☐ L elbow ☐ R elbow ☐

L wrist ☐ R wrist ☐ L hip ☐ R hip ☐ L knee ☐ R knee ☐

L ankle ☐ R ankle ☐ other ☐

Please explain any that you have checked

_____

_____

Other conditions/comments

_____

_____

Medications

Are you currently taking any prescription medications? ☐ Yes ☐ No

If yes, what and how much?

_____

_____

_____

Are you currently taking any over-the-counter medications or vitamins? ☐ Yes ☐ No

If yes, what and how much?

_____

_____

_____

Health habits

Smoking history:

Do you smoke? ☐ Yes ☐ Quit ☐ Never

What do/did you smoke? ☐ Cigarettes ☐ Cigars ☐ Pipe ☐ E-cig

How much did/do you smoke a day?

_____

How long have you been smoking? _____

If quit, when? _____

Exercise Habits

Do you engage in physical activity? ☐ Yes ☐ No

What kind?

_____

_____

How hard? ☐ Light ☐ Moderate ☐ Hard How often? _____

Did your past exercise habits differ from what you are doing now? ☐ Yes ☐ No

What kind of exercise did you do in the past?

_____

_____

How hard? ☐ Light ☐ Moderate ☐ Hard How often? _____

Is your occupation ☐ Sedentary ☐ Active ☐ Heavy work

Explain:

_____

_____

Do you experience discomfort, shortness of breath, or pain with exercise? ☐Yes ☐No

If yes, what type of exercise/symptoms?

_____

_____

Nutritional Behavior

Do you consider yourself overweight? ☐ Yes ☐ No

If yes, how long have you been overweight? _____

How many meals do you typically eat per day? _____

How often do you eat outside the home? _____ per week

How much of the following do you consume?

_____ cups of caffeinated coffee or tea per day

_____ glasses of caffeinated soda per day

_____ glasses of beer per day (12oz. = 1 unit)

_____ glasses of wine per day (4 oz. = 1 unit)

_____ glasses of liquor per day (11/2 oz. = 1 unit)

_____ units of alcohol per week (see above for unit equivalent)

Stress

Do yo u consider your day stressful? ☐ Yes ☐ No

What is the nature of your stress?

_____

_____

How many hours do you sleep a night? _____ Is your sleep sound? ☐ Yes ☐ No

Do you practice any form of meditation? ☐ Yes ☐ No

If so, what kind?

_____

_____

What is your preferred training schedule? (days/hours of availability)

_____

_____

Personal Assessment

Name_____ Date_____

RHR_____ RBP_____ Weight_____

Postural Assessment:

	Yes	No	Severe	Moderate	Minimal	Laterally	Medially
Forward Head							
Tilted Head							
Kyphosis							
Round Shoulder (L)							
Round Shoulder (R)							
Elevated Shoulder (L)							
Elevated Shoulder (R)							
Winged Scapula (L)							
Winged Scapula (R)							
Scoliosis							
Lordosis							
Hips Level							
Hip Elevated (L)							
Hip Elevated (R)							
Hips Anterior Tilt							
Hips Posterior Tilt							
Hips Rotated (L)							
Hips Rotated (R)							
Knee Rotated (L)							
Knee Rotated (R)							
Foot Everted (L)							
Foot Everted (R)							
Foot Inverted (L)							
Foot Inverted (R)							
Foot Supinated							

(L)							
Foot Supinated (R)							
Foot Pronated (L)							
Foot Pronated (R)							

Modified Thomas Test:

	Slight	Moderate	Severe
Hip Flexor (L)			
Hip Flexor (R)			
Quadricep (L)			
Quadricep (R)			
ITB (L)			
ITB (R)			
Foot (L)			
Foot (R)			

ROM Assessment:

	Supine Left	Supine Right	Upright Left	Upright Right
Shoulder Flexion				
Shoulder Extension				
Shoulder Abduction				
Shoulder IR				
Shoulder ER				
Hip Flexion				
Hip Extension				
Hip Abduction				
Hip Adduction				
Knee Flexion				
Knee Extension				

Girth Measurements:

	Right	Left
Neck		
Chest		
Waist		
Lower Abdomen		
Hips		
Upper Thigh		
Mid-Thigh		
Knee		
Calve		
Ankle		
Wrist		
Mid-Ulna		
Elbow		
Mid-Humerus		

Balance Assessment:

	Left	Right
Single Leg Stance		
Trendelenburg Test		

1) How would you rate your overall satisfaction with life?

○ poor ○ below average ○ good ○ very good ○ excellent

2) How would you rate your current health and wellbeing?

○ poor ○ below average ○ good ○ very good ○ excellent

3) How often do you get sick or go to the doctor?

○ once a week ○ twice a month ○ once a month ○ once every six months
○ once a year

4) How would you rate your past fitness level?

○ poor ○ below average ○ good ○ very good ○ excellent

5) How would you rate your current fitness level?

○ poor ○ below average ○ good ○ very good ○ excellent

6) How would you rate your perceived body image?

○ poor ○ below average ○ good ○ very good ○ excellent

7) How would you rate your current energy level?

○ poor ○ below average ○ good ○ very good ○ excellent

8) How would you rate your current ability to enjoy activities?

○ poor ○ below average ○ good ○ very good ○ excellent

9) How would you rate your current mobility?

○ poor ○ below average ○ good ○ very good ○ excellent

10) How would you rate your current level of pain?

○ no pain ○ manageable pain ○ chronic pain ○ unbearable pain

11) How would you rate your past eating habits?

○ poor ○ below average ○ good ○ very good ○ excellent

12) How would you rate your current eating habits?

○ poor ○ below average ○ good ○ very good ○ excellent

13) How would you rate your current ability to perform activities of daily living (bathing, grooming, dressing, cooking, cleaning…)?

○ poor ○ below average ○ good ○ very good ○ excellent

14) How would you rate your current ability to perform work-related tasks?

○ poor ○ below average ○ good ○ very good ○ excellent

15) How would you rate your sleep at night?

○ poor ○ below average ○ good ○ very good ○ excellent

16) How would you rate your current mood?

○ depressed ○ mildly depressed ○ content ○ happy ○ very happy

Contract for Personal Fitness Services from The Cancer Exercise Training Institute

Our goal at the Cancer Exercise Training Institute is to provide a client personalized fitness training including cardiovascular conditioning, weight training, flexibility, and range of motion, as well as postural deficiencies and corrections. The Cancer Exercise Training Institute is dedicated to the overall success of each client's personal health and fitness program.

- **Payment –** Payment for personal training services will be billed up front prior to the date of the first training session.

- **Sessions –** Each session will be one hour in length. Client agrees to be on time for each session. The session starts and ends when scheduled. If the client is late, the session will end as scheduled despite his/her lateness.

  Once a session is scheduled between the client and Cancer Exercise Training Institute, it is the client's responsibility to either attend the scheduled session or provide Cancer Exercise Training Institute with at least twenty-four hours' notice of cancellation. If the client cancels within twenty-four hours of the session, the client shall be responsible for the session.

- **Physician's Approval –** The client must fill out and submit the health history questionnaire form and medical clearance form along with this liability release, and made part of the agreement together with any documents, reports, or other information provided by client's physician or doctor. Cancer Exercise Training Institute has the right to refuse any session to a client at any time based upon his/her physical condition.

- **Waiver –** The client is aware that Cancer Exercise Training Institute sessions include strength, flexibility, and aerobic exercise, which may be potentially hazardous activities. The client also acknowledges that these activities involve a risk of injury and death. Accordingly, the client voluntarily consents to participate in Cancer Exercise Training Institute sessions, and assumes the acknowledged risks involved.

The client hereby waives, release, and forever discharges Cancer Exercise Training Institute, its officers, agents, employees, representatives, and executors, from any and all responsibilities or liability from injuries or damages resulting from participation in a class. Client also agrees that Cancer Exercise Training Institute, its officers, agents, employees, representatives, and executors shall not be liable for any claim, demand, cause, or action of any kind whatsoever for, or on the account of death, personal injury, property loss, or damage resulting from participation in any session.

_____ _____

Client Signature Date

MEDICAL CLEARANCE FORM

Dear Doctor:

_____ has applied for enrollment in the fitness testing and exercise programs at the Cancer Exercise Training Institute. The fitness testing program involves a submaximal test for cardiorespiratory fitness, sit and reach flexibility test, arm girth measurements, postural assessment, shoulder ROM test, muscular strength and muscular endurance tests. The exercise program is designed to start with basic stretching and flexibility exercises along with the use of light resistance to increase upper and lower body strength. The client is evaluated every six weeks to reassess their status and determine whether or not to advance them to the next level of difficulty. The program will take the client through various levels of increasing difficulty. All of our trainers are certified by the Cancer Exercise Training Institute as a Cancer Exercise Specialist. Thus they have undergone thorough and intensive training in working with the special needs of cancer survivors.

By completing the form below, however, you are not assuming any responsibility for our administration of the fitness testing and/or exercise programs. If you know of any medical or other reasons why participation in the fitness testing and/or exercise programs by the applicant would be unwise, please indicate so on this form. If you have any questions about the program, please don't hesitate to call us at:

REPORT OF PHYSICIAN

☐ I know of no reason why the applicant may not participate

☐ I believe the applicant can participate, but I urge caution because:

_____

☐ The applicant should not engage in the following activities:

_____

☐ I recommend that the applicant not participate.

_____ _____

Physician Signature Date

Address _____ Phone _____

City and State _____ Zip _____

BCRBS Background Information

The Cancer Exercise Specialist Advanced Qualification was developed for health and fitness professionals seeking to attain a higher level of mastery and work with cancer patients in post-operative exercise and quality of life programs. Following the workshop, there will be a take-home examination that candidates must pass in order to receive their advanced qualification.

The course consists of the following:

- Exercise implications and contraindications for 25 types of cancer (as well as pediatrics), surgery, reconstruction, and treatments
- Breast reconstruction and contraindications to exercise
- Preventing and identifying lymphedema
- Cancer related pain
- Mental and physical fatigue during cancer treatment
- Conducting a postural and range of motion assessment, interpreting the results, and creating an individualized exercise program
- Working with the medical professionals – Marketing strategies
- Neurological complications of cancer treatment
- Adapting your equipment to various cancer procedures to avoid injury and maximize benefits
- Conquering Cancer With Nutrition – Dr. Glenn B. Gero

This program is based, in part, on "Essential Exercises for Breast Cancer Survivors" and the EM-POWER Program, originally developed by CES professional and author Andrea Leonard with the following medical advisory board:

Dr. Theodore Tsangaris, Jr. -	Former Chief of Breast Surgery at the Georgetown University Medical Center, Chief of Breast Surgery at Johns Hopkins Medical Center
Dr. Katherine Alley	Chief of Breast Surgery at Suburban Hospital

Dr. Shawna Willey	Former Chief of Breast Surgery at the George Washington University Medical Center, Chief of Breast Surgery at the Georgetown University Medical Center
Dr. Richard Flax	Breast Surgeon at the Columbia Hospital for Women
Jean Lynn, R.N.	Oncology Nurse, Mammocare Director at the George Washington University Medical Center
Rosalie Begun, P.T.	Physical Therapist at Begun Physical Therapy
Amy Halverstadt, M.S.	Exercise Physiologist, Co-author of "Essential Exercises for Breast Cancer Survivors."

Andrea Leonard has been conducting the Cancer Exercise workshops nationwide since 1995. She is Co-author of "Essential Exercises for Breast Cancer Survivors," Founder and President of The Cancer Exercise Training Institute, and a continuing education provider for The American Council on Exercise and The National Academy of Sports Medicine. Andrea is certified as a Special Populations expert by The Cooper Institute, as a Personal Trainer by the American Council on Exercise and The American College of Sports Medicine, as an Optimum Performance Trainer and Corrective Exercise Specialist by The National Academy of Sports Medicine, and as a Strength and Conditioning Coach by The National Sports Professionals Association.

Sample Press Release

Contact:
Cancer Exercise Training Institute
3436 NE 21st Ave.
Portland, OR 97212
Contact: Andrea Leonard, (503) 502-6776

MEDICAL AND FITNESS PROFESSIONALS NATIONWIDE HELP CANCER PATIENTS TO PREVENT AND REVERSE THE RAVAGES OF CANCER SURGERY AND TREATMENT

Andrea Leonard, CANCER SURVIVOR, Co-Author of "Essential Exercise for Breast Cancer Survivors," Founder of the Breast Cancer Survivors Foundation and President of The Cancer Exercise Training Institute, has been conducting two-day Cancer and Exercise Workshops for health and fitness professionals nationwide since 2001. Students in her classes are naturopathic doctors, nurses, physical therapists, personal fitness trainers, and Yoga and Pilates instructors. Thanks to Andreas' comprehensive Cancer Exercise Specialist Advanced Qualification, there are now thousands of professionals covering the United States, British Columbia, The Netherlands, Greece, Australia, Singapore, Israel, and Puerto Rico. The Cancer Exercise Specialist is truly a pioneer in the practice of cancer recovery and rehabilitation from the debilitating side-effects of cancer surgery and treatment. For more information on upcoming workshops you can visit the website at www.thecancerspecialist.com.

"This Advanced Qualification is to cancer, what Cardiac Rehabilitation has been for heart attack victims," declares Andrea Leonard, Cancer Exercise Training Institute President, and herself a twenty-five year cancer survivor.

Following cancer surgery and treatment there are numerous physically debilitating side-effects that cancer patients have become accustomed to living with. We want to make it known that cancer survivors no longer have to accept the fact that they have limited range of motion, poor posture, neck and back pain, lymphedema, chronic fatigue etc… following their treatment. We have the answers and can help to reverse many, if not all, of the agonizing problems that chronically plague cancer survivors nationwide. In addition to the many public and private facilities that now have Cancer Exercise Specialists; we have certified professionals at Hospitals and hospital-based wellness facilities across the country.

"After 24 years in the fitness industry, I once again feel as I am making a difference in my clients' lives. It's so empowering to work with people that do NOT take every day for granted and are motivated to improve every aspect of their remaining time. As selfish as this may sound, I feel that I am getting as much if not more out of this than my clients."

Robert Reed III, Certified Personal Trainer and Cancer Exercise Specialist, San Antonio, TX

Sample Letter to Doctor When Working with their Patient

February 1, 2015

Dear Dr. Rubin,

My name is Andrea Leonard. I live in West Linn and am a Cancer Exercise Specialist. I am Co-author of "Essential Exercises for Breast Cancer Survivors," and president of The Cancer Exercise Training Institute. Today I had the good fortune of meeting with one of your breast cancer patients, Deborah Searfus. I conducted a comprehensive evaluation of Deborah's ROM, arm girth measurements, and a postural assessment to determine muscle imbalances that exist prior to her mastectomy; so that we have a base for comparison later. Following her mastectomy, we will repeat this process. I have enclosed a pre-operative report for you, listing all of my findings along with a very brief synopsis of my intended exercise programming. She already has limited abduction in her right arm, possibly having something to do with the tumor location and depth. Flexion is also slightly limited. Her other measurements are within normal range. If you have any questions or concerns, or if I can be of assistance to any of your other patients, please don't hesitate to contact me at (503) 502-6776.

If you would ever like to have coffee, I would love to be able to share more of what I do with you.

Respectfully,

Andrea Leonard

Sample Marketing Letter to Doctor

February 1, 2015

Dear Dr. Nakamura,

My name is Andrea Leonard and I am a Cancer Exercise Specialist residing in West Linn, OR. I wanted to take this opportunity to introduce myself and offer my services to your patients. I work individually with clients, helping to minimize the side effects of treatment, reverse postural and range of motion issues that arise from surgery and reconstruction, and focus on awareness and prevention of lymphedema. I have enclosed a recent article from the Oregonian which explains what I do and what my background is. The following is a summary of my qualifications:

- Adjunct member of the American Council on Exercise and National Academy of Sports Medicine Faculty
- National presenter of accredited Cancer and Exercise Workshop
- Co-author of "Essential Exercises for Breast Cancer Survivors"
- Author of "The Cancer and Exercise Handbook"
- President of Leading Edge Fitness
- President/Founder of The Cancer Exercise Training Institute
- B.A. University of MD, 2000
- Certified Personal Trainer, Conditioning Specialist, and Special Populations Expert:
    - American College of Sports Medicine
    - National Academy of Sports Medicine
    - American Council on Exercise
    - National Sports Professionals Association
    - Cooper Institute

I would welcome the opportunity to have coffee with you and answer any questions that you may have. I can also provide you at that time with references; if you would like to see them. I hope to have the opportunity to serve your patients in the near future.

In Health,

Andrea Leonard

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Advanced cancer – cancer that has spread to other places in the body and usually cannot be cured or controlled with treatment.

Aerobic – reactions that need oxygen to happen or happen when oxygen is present.

Aerobic exercise – physical activity that increases the heart rate and the body's use of oxygen.

Aerobic metabolism – a chemical process in which oxygen is used to make energy from carbohydrates (sugars). Also called aerobic respiration, cell respiration, and oxidative metabolism.

Aerobic respiration – a process in which oxygen is used to make energy from carbohydrates.

Afferent (neurons) – also known as sensory neurons, they gather incoming sensory information from the environment and deliver it to the central nervous system (CNS).

Affinitor® (Everolimus) – also blocks the mTOR protein. It is taken as a pill once a day. Everolimus is used to treat advanced kidney cancers after other drugs such as sorafenib or sunitinib have been tried.

Aggressive – a tumor or disease that forms, grows, or spreads quickly. It may also describe treatment that is more severe or intense than usual.

Agonist – muscles that act as prime movers.

AIDS-related cancer – types of cancer that are more likely to occur in people who are infected with HIV. The most common types are Kaposi sarcoma and non-Hodgkin lymphoma. Other AIDS-related cancers include Hodgkin disease and cancers of the lung, mouth, cervix, and digestive system.

Alcohol ablation – ethanol (alcohol) is injected through the skin directly into a tumor to kill cancer cells. Ultrasound or a CT scan is used to guide the needle into the tumor

Aldosterone blockers – balance electrolytes in the body and help muscle and nerve tissue to work properly.

Allergic response – a hypersensitive immune reaction to a substance that normally is harmless in most people. An allergic response may cause symptoms such as itching, inflammation, or tissue injury.

Alloantigen - a genetically determined antigen present in some but not all individuals of a species (as those of a particular blood group) and capable of inducing the production of an alloantibody by individuals which lack it.

Allogeneic – taken from different individuals of the same species or an artificial transplant.

Allogeneic bone marrow transplantation – a procedure in which a person receives stem cells from a genetically compatible donor.

Allogeneic stem cell transplantation – a procedure in which a person receives bloodforming stem cells from a genetically compatible donor.

Allograft – the transplant of an organ, tissue, or cells from one individual to another individual of the same species who is a genetically compatible donor.

Allopathic medicine – a system in which healthcare professionals treat symptoms and diseases using drugs, radiation, or surgery. Also called biomedicine, conventional medicine, mainstream medicine, and Western medicine.

Alopecia – results in hair falling out in patches

Altered reciprocal inhibition – this is the process by which a tight muscle causes decreased neural drive and, therefore, optimal recruitment of its functional antagonist is not achieved.

Alveolar soft-part sarcoma – is a rare cancer that mostly affects young adults. These tumors most commonly occur in legs.

Amputation – the removal by surgery of a limb or other body part because of injury or disease.

Analysis – a process in which anything complex is separated into simple or less complex parts.

Anaphylactic shock – a severe and sometimes life-threatening immune system reaction to an antigen that a person has been previously exposed to. The reaction may include itchy skin, edema, collapsed blood vessels, fainting, difficulty in breathing, and death.

Anaplastic – describes cancer cells that divide rapidly and have little or no resemblance to normal cells.

Anaplastic thyroid cancer – a rare and very aggressive type of thyroid cancer.

Anastomosis - is the area where the 2 ends of the digestive tract are joined together.

Anastomotic leak - after anterior resection of the rectum should be defined as a communication between the intra- and extraluminal compartments owing to a defect of the integrity of the intestinal wall at the anastomosis between the colon and rectum or the colon and anus.

Androgen – a type of hormone that promotes the development and maintenance of male sex characteristics.

Androgen ablation – treatment to suppress or block the production or action of male hormones. This can be done by removing the testicles, by taking female sex hormones, or by taking antiandrogens.

Androgen deprivation – treatment to suppress or block the production or action of male sex hormones. This can be done by removing the testicles, by taking female sex hormones, or by taking antiandrogens.

Anemia – a condition in which the number of red blood cells is below normal.

Anesthesia – loss of feeling or awareness caused by drugs or other substances. Anesthesia keeps a patient from feeling pain during surgery or other procedures. Local anesthesia is a loss of feeling in one small area of the body. Regional anesthesia is a loss of feeling in a part of the body. General anesthesia is a loss of feeling and a complete loss of awareness similar to a very deep sleep.

Anesthesiologist – a doctor who specializes in giving drugs or other agents that keep a patient from feeling pain during surgery or other procedures.

Aneurysm – an abnormal widening or ballooning of a portion of an artery due to weakness in the wall of the blood vessel.

Angina – is chest discomfort due to poor blood flow through the blood vessels in the heart.

Angiogenesis – the process of making new blood vessels.

Angiography - a special x-ray that uses dye so that the blood vessels can be seen.

Angiosarcoma (includes hemangiosarcoma and lymphangiosarcoma) – can develop either from blood vessels (hemangiosarcomas) or from lymph vessels (lymphangiosarcomas). These tumors sometimes start in a part of the body that has been treated with radiation. Angiosarcomas are sometimes seen in the breast after radiation therapy and in limbs with lymphedema.

Anorexia – an abnormal loss of the appetite for food that may result in extreme weight loss. Anorexia can be caused by cancer, AIDS, a mental disorder, or other diseases.

Antagonist – a muscle that acts in direct opposition to a prime mover

Anterior – the opposite of posterior. Referring to a position on or near the front of the body.

Anterior pelvic tilt (lordosis) – the opposite of posterior pelvic tilt (flat back). A movement in which the pelvis rotates forward.

Antiarrythmics – help to prevent arrhythmias.

Antibacterial – a substance that kills bacteria or stops them from growing.

Antibiotic – a drug used to treat infections caused by bacteria and other microorganisms.

Antibody – a protein made by plasma cells in response to an antigen (a substance that causes the body to make a specific immune response). Each antibody can bind to only one specific antigen. The binding helps to destroy the antigen. Some antibodies destroy antigens directly. Others make it easier for white blood cells to destroy the antigen.

Anticoagulants – prevent blood clots from forming.

Antidepressant – a drug used to treat depression.

Antigen - a toxin or other foreign substance which induces an immune response in the body, especially the production of antibodies.

Antihistamine – a type of drug that blocks the action of histamines, which can cause fever, itching, sneezing, a runny nose, and watery eyes. Antihistamines are used to prevent fevers in clients receiving blood transfusions and may be used to treat allergies, coughs, and colds.

Antimetabolite – a drug that is similar to the natural chemicals in a normal biochemical reaction that occurs in cells, but different enough to interfere with the normal division and functions of the cells.

Antioxidant – a substance that protects cells from the damage caused by free radicals (unstable molecules made by the process of oxidation during normal metabolism). Free radicals may play a part in cancer, heart disease, stroke, and other diseases of aging. Antioxidants include beta-carotene, lycopene, vitamins A, C, and E, and other natural and manufactured substances.

Aorta – the largest artery in the body. It carries oxygen-rich blood away from the heart to vessels that reach the rest of the body.

Aortic stenosis – when the aortic valve does not open fully. This decreases blood flow from the heart.

Apheresis – a procedure in which blood is collected, part of the blood such as platelets or white blood cells is taken out, and the rest of the blood is returned to the donor.

Apoptosis – programmed cell death.

Appetite – a desire to satisfy a physical or mental need, such as for food, sex, or adventure.

Acquired (somatic) gene mutations – changes in DNA that develop throughout a person's lifetime.

Areola – the area of dark-colored skin on the breast that surrounds the nipple.

Aromatase inhibitor – are used as a type of hormone therapy for postmenopausal women who have hormone-dependent breast cancer. It is a drug that prevents the formation of estradiol, a female hormone, by interfering with an aromatase enzyme.

Arrhythmia – is a disorder of the heart rate (pulse) or heart rhythm. The heart can beat too fast (tachycardia), too slow (bradycardia), or irregularly.

Arrhythmogenic right ventricular dysplasia – is a rare type of cardiomyopathy that occurs when the muscle tissue in the right ventricle is replaced with fatty or fibrous tissue.

Arsenic - is a chemical element with symbol As and atomic number 33. Arsenic occurs in many minerals, usually in combination with sulfur and metals, but also as a pure elemental crystal. Arsenic is a metalloid. It has various allotropes, but only the gray form, which has a metallic appearance, is important to industry.

Arsenic trioxide (ATO) – is a non-chemo drug for people at higher risk of APL coming back after treatment; the targeted drug gemtuzumab ozogamicin (Mylotarg) might be added as well.

Arterial embolization – the blocking of an artery by a clot of foreign material. This can be done as treatment to block the flow of blood to a tumor.

Arterial hypertension – is a progressive disorder characterized by abnormally high blood pressure (hypertension) in the pulmonary artery, the blood vessel that carries blood from the heart to the lungs.

Arthritis – chronic inflammation of the joint. Can be osteoarthritis or rheumatoid arthritis.

Arthroplasty – a reconstructive procedure to replace a limb that uses a metallic or bone allograft. The implant, however, is an artificial joint that will not tolerate activities such as jogging, racquet sports, or heavy lifting.

Articular - of or relating to joints or to the structural components in a joint.

Asbestos – tiny fibers that are used as insulation against heat and fire in buildings. Loose asbestos fibers that are breathed into the lungs can cause lung cancer and malignant mesothelioma (cancer found in the lining of the lungs, chest, or abdomen). Asbestos that is swallowed may cause cancer of the gastrointestinal tract.

Ascites - the accumulation of fluid in the peritoneal cavity, causing abdominal swelling.

Aspiration – the removal of fluid or tissue through a needle. Also, the accidental breathing in of food or fluid into the lungs.

Asplenia - refers to the absence of normal spleen function and is associated with some serious infection risks.

Assessment – a process used to learn about a patient's/client's condition. This may include a complete medical history, medical tests, a physical exam, a mental health evaluation, etc.

Asthma – is a disorder that causes the airways of the lungs to swell and narrow, leading to wheezing, shortness of breath, chest tightness, and coughing.

Astrocytomas – are the most common form of adult brain tumor. They take hold in the star-shaped glial cells called astrocytes.

Asymmetry – lack or absence of balanced proportions between parts of a thing.

Ataxia – the loss of full control of bodily movements.

Atrioventricular (AV) block – is partial or complete interruption of impulse transmission from the atria to the ventricles. The most common cause is idiopathic fibrosis and sclerosis of the conduction system.

Atypical hyperplasia – a benign condition in which cells look abnormal under a microscope and are increased in number.

Autologous – taken from an individual's own tissues, cells, or DNA. Autologous bone marrow transplant – refers to a person's own bone marrow being used for a transplant.

Avastin® (Bevacizumab) – is considered an angiogenesis inhibitor (a medication that works to prevent cancers from making new blood vessels). It appears to prolong survival in those with advanced non-small cell lung cancer.

Axilla – the underarm or armpit.

Axillary – pertaining to the armpit area, including the lymph nodes that are located there (axillary lymph nodes).

Axillary dissection – surgery to remove lymph nodes in the armpit region. Known as an axillary lymph node dissection.

Axillary lymph node – a lymph node in the armpit region that drains lymphatic fluid from the breast and nearby areas.

Axillary web syndrome (lymphatic cording) – is a visible web of axillary skin overlying palpable cords of tissue. It occurs exclusively in conjunction with ALND.

Axitinib (Inlyta) - treatment option for kidney cancer.

B symptoms - refers to systemic symptoms of fever, night sweats, and weight loss which can be associated with both Hodgkin's lymphoma and non-Hodgkin's lymphoma. The presence or absence of B symptoms has prognostic significance and is reflected in the staging of these lymphomas.

Bacillus Calmette-Guerin (BCG) – is considered the most effective intravesical immunotherapy for treating early stage bladder cancer.

Bacteria – a large group of single-cell microorganisms that may cause infections and disease in animals and humans.

Balance – the ability to sustain the body's center of mass over its base of support.

Barium swallow – the process of getting x-ray pictures of the esophagus or the upper GI tract (esophagus, stomach, and duodenum), following the ingestion of a liquid that contains barium. The barium coats and outlines the inner walls of the esophagus and the upper GI tract so that they can be seen on the x-ray pictures.

Basal cell carcinoma – cancer that begins in the lower part of the epidermis (the outer layer of the skin). It may appear as a small white or pearly bump that grows slowly and may crust over and bleed. Basal cell carcinomas are usually found on areas of the body exposed to the sun. They are the most common form of skin cancer and seldom metastasize to other parts of the body.

Baseline – an initial measurement that is taken to represent a beginning condition or starting point. It may be used for comparison over time to look for changes or improvements.

Bence Jones protein – a small protein made by plasma cells that are found in the urine of most people with multiple myeloma.

Benign tumor – a growth that is not cancer.

Bilateral cancer – cancer that occurs in both of a pair of organs.

Bilateral nephrectomy – surgery to remove both kidneys.

Bilateral prophylactic mastectomy – surgery to remove both breasts in order to reduce the risk of developing breast cancer. It's often the choice of a patient who tests positive for BRCA1 and BRCA2.

Bilateral salpingo-oophorectomy – surgery to remove both ovaries and both fallopian tubes.

Bile – fluid made by the liver that is stored in the gallbladder. Bile is excreted into the small intestine where it helps digest fat.

Bile duct – a tube through which bile passes in and out of the liver.

Bile duct cancers (cholangiocarcinomas) - one or two of every 10 cases of liver cancer start in the bile ducts, which are small tubes that carry bile to the gallbladder. They are treated in the same way as HCC.

Biliary – having to do with the liver, bile ducts, and/or gallbladder.

Biliary bypass surgery – this procedure is performed when an inoperable tumor is blocking the duodenum, causing bile fluid to build up in the gallbladder, or when it is blocking the common bile duct that passes through the pancreas. In the first situation, the surgeon bypasses the bile duct to the jejunum, the section of the small intestine below the duodenum. In the next situation, a catheter tube is surgically implanted in the bile duct. The fluid then drains into a small external bag. A nerve block is performed during the operation to relieve pain.

Biliary system – the organs and ducts that make and store bile and release it into the small intestine. The biliary system includes the gallbladder and bile ducts inside and outside the liver.

Biological agent – a substance that is made from a living organism or its products and is used in the prevention, diagnosis, or treatment of cancer and other diseases. Biological agents include antibodies, interleukins, and vaccines.

Biological therapy – treatment to boost or restore the ability of the immune system to fight cancer, infections, and other diseases. Agents used include monoclonal antibodies, growth factors, and vaccines.

Biopsy – the removal of cells or tissues for examination by a pathologist. There are many different types of biopsy procedures including: (1) incisional biopsy, in which only a sample of tissue is removed; (2) excisional biopsy, in which an entire lump or suspicious area is removed; and (3) needle biopsy, in which a sample of tissue or fluid is removed with a needle. When a wide needle is used, the procedure is called a core biopsy. When a thin needle is used, the procedure is called a fine-needle aspiration biopsy.

Bisphosphonate therapy – a class of drugs which are used to prevent bone loss, reduce the risk of fractures, and decrease pain.

Bladder cancer – cancer that forms in tissues of the bladder.

Bladder fibrosis - is scarring and hardening of the tissue in the bladder.

Blister – a fluid-filled sac in the outer layer of skin that can be caused by certain treatments, rubbing, heat, or diseases of the skin.

Bloating – a swelling or feeling of fullness in the abdomen that is usually the result of gas in the intestines and can be caused by many things, including overeating, lactose intolerance, and constipation. In some cases, bloating can also be a side effect of cancer or cancer treatment.

Blood – a tissue with red blood cells, white blood cells, platelets, and other substances suspended in fluid called plasma. Blood takes oxygen and nutrients to the tissues and carries away wastes.

Blood cancer – cancer that begins in blood-forming tissue, such as the bone marrow, or in the cells of the immune system. Examples of blood cancer are leukemia, lymphoma, and multiple myeloma. Also called hematologic cancer.

Blood cell count - a measure of the number of red blood cells, white blood cells, and platelets in the blood. The amount of hemoglobin and hematocrit is also measured. A blood cell count is used to help diagnose and monitor many conditions.

Blood clot – a mass of blood that forms when blood platelets, proteins, and cells stick together. When a blood clot is attached to the wall of a blood vessel, it is called a thrombus. When it moves through the bloodstream and blocks the flow of blood in another part of the body, it is called an embolus.

Blood poisoning – disease caused by the spread of bacteria and their toxins in the bloodstream.

Blood pressure – the force of circulating blood on the walls of the arteries.

Blood sugar – glucose (a type of sugar) found in the blood.

Blood test – a test done on a sample of blood to measure the amount of certain substances in the blood or to count different types of blood cells.

Blood thinner – a substance that is used to prevent and treat blood clots in blood vessels and the heart. It is also called an anticoagulant.

Blood vessel – a tube through which the blood circulates in the body. Blood vessels include a network of arteries, arterioles, capillaries, venules, and veins.

Blood-brain barrier – a network of blood vessels and tissue that is made up of closely spaced cells that help to keep harmful substances from reaching the brain. The blood-brain barrier lets some substances, such as water, oxygen, carbon dioxide, and general anesthetics, pass into the brain. This can make getting adequate concentrations of chemotherapy to the brain very difficult.

Blood-brain barrier disruption – the use of drugs to create openings between cells in the blood-brain barrier. Once the barrier is opened, anticancer drugs may be infused into an artery that goes to the brain, bypassing the blood-brain barrier.

Bone cancer – primary bone cancer is cancer that forms in cells of the bone. Secondary bone cancer is cancer that spreads to the bone from another part of the body.

Bone cement implantation syndrome (BCIS) - is poorly understood. It is an important cause of intraoperative mortality and morbidity in patients undergoing cemented hip arthroplasty and may also be seen in the postoperative period in a milder form causing hypoxia and confusion.

Bone density – a measure of the amount of minerals, primarily calcium and phosphorous, contained in a certain volume of bone. Bone density measurements are used to diagnose osteoporosis and to see how well osteoporosis treatments are working. Low bone density is a common side-effect that can occur in clients treated for cancer.

Bone marrow – the soft, sponge-like tissue in the center of most bones. It produces white blood cells, red blood cells, and platelets.

Bone marrow ablation – a procedure to destroy bone marrow using radiation or high doses of anticancer drugs. It is done before a bone marrow or blood stem cell transplant to kill cancer cells and bone marrow cells and to create space for the healthy cells.

Bone marrow aspiration – a procedure in which a small sample of bone marrow is removed, usually from the hip bone, breastbone, or thigh bone.

Bone marrow transplantation – a procedure to replace bone marrow that has been destroyed by treatment with high doses of anticancer drugs or radiation

Bone metastasis – cancer that has spread from the original (primary) tumor to the bone.

Bone mineral density scan – an imaging test that measures bone by passing x-rays with two different energy levels through the bone. It is used to diagnose osteoporosis.

Bone scan – a technique to create images of bones on a computer screen or on film. A small amount of radioactive material is injected into a blood vessel and travels through the bloodstream; it collects in the bones and is detected by a scanner.

Bowel – the long, tube-shaped organ in the abdomen that completes the process of digestion. Is made up of two parts; the small bowel and the large bowel.

Brachytherapy – a type of radiation therapy in which radioactive material sealed in needles, seeds, wires, or catheters is placed directly into or near a tumor. It is also called seed implant radiation therapy.

Bradyarrhythmia – any disturbance of cardiac rhythm in which the heart rate is less than 60 beats/min.

Brain metastasis – cancer that has spread from the primary tumor to the brain.

Brain-stem gliomas – only represent about 5% of all adult brain tumors. They are usually made up of astrocytomas but may contain other types of cells as well.

Brain tumor – the growth of abnormal cells in the tissues of the brain. Brain tumors can be benign or malignant.

BRCA1 – a gene on chromosome 17 that normally helps to suppress cell growth. A person who inherits certain mutations in a BRCA1 gene has a higher risk of getting breast, ovarian, prostate, and other types of cancer.

BRCA2 – a gene on chromosome 13 that normally helps to suppress cell growth. A person who inherits certain mutations in a BRCA2 gene has a higher risk of getting breast, ovarian, prostate, and other types of cancer.

Breast – a glandular organ located on the chest. The breast is made up of connective tissue, fat, and breast tissue that contains the glands that can make milk.

Breast cancer – cancer that forms in tissues of the breast, usually the ducts and lobules. It can occur in both men and women; although male breast cancer is rare.

Breast carcinoma in situ – there are 3 types of breast carcinoma in situ: ductal carcinoma in situ (DCIS), lobular carcinoma in situ (LCIS), and Paget disease of the nipple. DCIS is a noninvasive condition in which abnormal cells are found in the lining of a breast duct. The abnormal cells have not spread outside the duct to other tissues in the breast. In some cases, DCIS may become invasive cancer and spread to other tissues. LCIS is a condition in which abnormal cells are found in the lobules of the breast. This condition seldom becomes invasive cancer. However, having LCIS in one breast increases the risk of developing breast cancer in either breast. Clients' with LCIS may opt for a prophylactic mastectomy. Paget disease of the nipple is a condition in which abnormal cells are found in the nipple only.

Breast density – describes the relative amount of different tissues present in the breast. A dense breast has less fat than glandular and connective tissue. Mammogram films of breasts with higher density are harder to read and interpret than those of less dense breasts.

Breast duct – a thin tube in the breast that carries milk from the breast lobules to the nipple. Also called milk duct.

Breast implant – a silicone or saline-filled sac placed under or above the chest muscle to restore breast shape or facilitate reconstruction.

Breast lobe – a section of the breast that contains the lobules (the glands that make milk).

Breast lobule – a small part of a lobe in the breast.

Breast reconstruction – surgery to rebuild the breast following a mastectomy.

Breast self-exam – an exam by a woman of her breasts to check for lumps or other changes. It is recommended to do a self-exam on a monthly basis.

Breast-conserving surgery – an operation to remove the breast cancer while leaving the breast intact. Types of breast-conserving surgery include and segmental mastectomy.

Breastbone (sternum) – the long flat bone that forms the center front of the chest wall. The breastbone is attached to the collarbone and the first seven ribs.

Bronchi – the large air passages that lead from the trachea (windpipe) to the lungs.

Bronchial – having to do with the bronchi.

Bronchiectasis – is a chronic condition where the walls of the bronchi are thickened from inflammation and infection.

Bronchiolitis obliterans - also known as popcorn lung and constrictive bronchiolitis, is a disease that results in obstruction of the smallest airways of the lungs (bronchioles) due to inflammation. Symptoms include a dry cough, shortness of breath, wheezing and feeling tired.

Bronchitis - is an inflammation of the lining of your bronchial tubes.

Bronchoscope – a thin, tube-like instrument used to examine the inside of the trachea, and lungs. A bronchoscope has a light and a lens at the tip for viewing and may have a tool to remove tissue.

Bronchoscopy – a procedure that uses a bronchoscope to examine the inside of the trachea, and lungs. The bronchoscope is inserted through the nose or mouth.
Bronchoscopy may be used to detect cancer or to perform certain treatment procedures.

Cachexia – loss of body weight and muscle mass, and weakness that may occur in clients with cancer, AIDS, or other chronic diseases.

Calcification – deposits of calcium in the tissues. Calcification in the breast can be seen on a mammogram but cannot be detected by touch. Macrocalcifications are large deposits and are usually not related to cancer. Microcalcifications are specks of calcium that may be found in an area of rapidly dividing cells. Many microcalcifications clustered together may be a sign of cancer.

Cancer – a term for diseases in which abnormal cells divide without control and can invade nearby tissues. Cancer cells can also spread to other parts of the body through the blood and lymph systems.

Capsular contracture – a condition in which scar tissue around the implant or expander hardens and then contracts. This can cause deformity, pain, and abnormal firmness of the breast.

CAR T Cell therapy – rapidly emerging immunotherapy for certain people, up to age 25, whose ALL has stopped responding to other therapies.

Carcinogen – any substance that causes cancer.

Carcinogenesis – the process by which normal cells are transformed into cancer cells.

Carcinoid – a slow-growing type of tumor usually found in the gastrointestinal system (most often in the appendix), and sometimes in the lungs or other sites. Carcinoid tumors may spread to the liver or other sites in the body, and they may secrete substances such as serotonin or prostaglandins, causing carcinoid syndrome.

Carcinoid syndrome – a combination of symptoms caused by the release of serotonin and other substances from carcinoid tumors of the gastrointestinal tract. Symptoms may include flushing of the face, diarrhea, bronchial spasms, rapid pulse, and sudden drops in blood pressure.

Carcinoma – cancer that begins in the skin or in tissues that line or cover internal organs.

Carcinoma in situ – a group of abnormal cells that remain in the place where they first formed, and they have not spread to surrounding tissue.

Cardiomyopathy - is a disease of the heart muscle that makes it harder for your heart to pump blood to the rest of your body. Cardiomyopathy can lead to heart failure. The main types of cardiomyopathy include dilated, hypertrophic and restrictive cardiomyopathy.

Cardiopulmonary – the relationship between the workings of the heart and lungs.

Cardiorespiratory – function of the heart in relationship to the body's entire breathing mechanism, from the nose and throat to the lungs.

Cardiotoxicity – toxicity that affects the heart.

Cardiovascular – directs the flow of blood throughout the body.

Carotid artery - major blood vessel in the neck that supplies blood to the brain.

Castration – removal or destruction of the testicles or ovaries using radiation, surgery, or hormonal therapy.

Catheter – a flexible tube used to deliver fluids into or withdraw fluids from the body.

Cavernoma - is a cluster of abnormal blood vessels, usually found in the brain and spinal cord. They're sometimes known as cavernous angiomas, cavernous hemangiomas, or cerebral cavernous malformation (CCM).

Celiac block (chemical splanchnicectomy) – is an effective way to control pain by injecting alcohol into the tangle of nerves that serve the pancreas, thereby destroying them. The procedure is often performed at the same time as surgery to bypass an obstructive tumor in the abdomen.

Cell type – describes the kinds of cells found in normal or cancer tissue. In cancer, it is important to know the cell type in order to diagnose the cancer, plan treatment, and determine prognosis.

Central nervous system (CNS) – the brain and spinal cord.

Cerebrospinal fluid – the fluid that flows in and around the hollow spaces of the brain and spinal cord, and between two of the meninges (the thin layers of tissue that cover and protect the brain and spinal cord).

Cervical – relating to the neck, or to the neck of any organ or structure.

Cervical cancer – cancer that forms in tissues of the cervix. It is usually a slow-growing cancer that may not have symptoms but can be found with a regular Pap screen. Cervical cancer is almost always caused by human papillomavirus (HPV) infection. There is now a vaccine for cervical cancer.

Cervical intraepithelial neoplasia – growth of abnormal cells on the surface of the cervix.

Cervical spine – the area of the spine that contain the 7 vertebrae that make up the neck.

Chemoembolization – a procedure in which the blood supply to a tumor is blocked after anticancer drugs are given in blood vessels near the tumor. This allows a higher concentration of the drug to reach the area that it is needed most, resulting in the death of a higher number of cancer cells. It also causes fewer side effects because very little of the drug reaches other parts of the body.

Chemoimmunotherapy – chemotherapy combined with immunotherapy. Chemotherapy uses different drugs to kill or slow the growth of cancer cells; immunotherapy uses treatments to stimulate or restore the ability of the immune system to fight cancer.

Chemoprevention – the use of drugs, vitamins, or other agents to try to reduce the risk of, or delay the development or recurrence of, cancer.

Chemoradiation – treatment that combines chemotherapy with radiation therapy.

Chemotherapeutic agent – a drug used to treat cancer.

Chemotherapy – treatment with drugs that kill cancer cells.

Chest wall – the muscles, bones, and joints that make up the area of the body between the neck and the abdomen.

Cholelithiasis - is the presence of one or more calculi (GALLSTONES) in the gallbladder.

Cholestasis – any condition in which the release of bile from the liver is blocked.

Chimeric antigen receptor (CAR) T-cell therapy - immune cells (T cells) are removed from the patient's blood and altered in the lab to have specific receptors (CHIMERIC ANTIGEN RECEPTORS, or CARs) on their surface. These receptors can attach to proteins on the surface of lymphoma cells. The T cells are then multiplied in the lab and given back into the patient's blood, where they can seek out the lymphoma cells and launch an all-out immune attack against them.

Chondrosarcoma – is a rare tumor that grows in the cartilage. It can often cause swollen joints or restrict range of motion. It is often found in the pelvic bone, long bones, scapula and base of ribs and, less frequently, in the bones of the hand, foot, nose, and base of skull. They can remain slow-growing, but when they become aggressive, can metastasize to the lungs and heart. Chondrosarcoma typically affects ages 30-60.

Chordomas - are rare tumors start in the bone at the base of the skull or at the lower end of the spine. Chordomas don't start in the central nervous system, but they can injure the nearby brain or spinal cord by pressing on it. These tumors are treated with surgery if possible, often followed by radiation therapy, but they tend to come back in the same area after treatment, causing more damage. They usually do not spread to other organs.

Choriocarcinomas – are a very rare and aggressive type of testicular cancer that occurs in adults. These cancers are likely to metastasize to distant organs of the body, including the lungs, bone, and brain. Pure choriocarcinoma does not often occur in the testicles. Typically, choriocarcinoma cells are present with other types of non-seminoma cells in a mixed germ cell tumor.

Choroid – the pigmented layer under the retina of the eye.

Choroidal melanoma – is the most common type of ocular melanoma.

Ciliary body – the ring-shaped muscle that changes the size of the pupil and the shape of the lens when the eye focuses.

Chromophobe RCC – accounts for 5-10% of kidney tumors. These are considered a less aggressive form of primary kidney cancer. Chromophobe tumors appear clear and pale like renal cell carcinoma but are larger size.

Chronic – a disease or condition that persists or progresses over a long period of time.

Chronic pain – pain that can range from mild to severe, and persists or progresses over a long period of time.

Circulatory system – the system that contains the heart and the blood vessels and moves blood throughout the body to supply oxygen and nutrients and eliminate waste products. The lymphatic system is often considered part of the circulatory system.

Cirrhosis – a type of chronic, progressive liver disease in which liver cells are replaced by scar tissue. It is often seen as a result of long-term alcohol abuse

Classical seminoma – more than 95% of seminomas are typical. These usually occur in men when they are between 25 and 45. Claudication - pain caused by too little blood flow, usually during exercise.

Clavicle (collarbone) – one of a pair of bones at the base of the front of the neck. The clavicles connect the breastbone to the shoulder blades.

Clear cell sarcoma – is a rare cancer that often develops in tendons of the arms or legs. Under the microscope, it has some features of malignant melanoma, a type of cancer that develops from pigment-producing skin cells. How cancers with these features start in parts of the body other than the skin is not known.

Colectomy – an operation to remove all or part of the colon. When only part of the colon is removed, it is called a partial colectomy.

Collecting duct – a type of kidney cancer that makes up less than 1% of all cases. This is a very rare and aggressive type of tumor that is more common in younger adults and doesn't respond to conventional therapies for renal cortical tumors.

Colo-anal anastomosis – the colon is connected to the anus following a proctectomy (surgical removal of the rectum).

Colon – the longest part of the large intestine (which is connected to the small intestine at one end and the anus at the other). The colon removes water and some nutrients and electrolytes from partially digested food. The remaining material, solid waste, moves through the colon to the rectum and leaves the body through the anus.

Colon cancer – cancer that forms in the tissues of the colon. Most colon cancers are adenocarcinomas (cancers that begin in cells that make and release mucus and other fluids).

Colonoscopy – examination of the inside of the colon through the rectum, using a colonoscope. A colonoscope is a thin instrument with a light and a lens at the tip for viewing. It may also have a tool to remove tissue to be checked under a microscope for signs of disease.

Colorectal – having to do with the colon or the rectum.

Colorectal cancer – cancer that develops in the colon and/or the rectum.

Colostomy – an opening into the colon from the outside of the body. A colostomy provides a new path for waste material to leave the body after part of the colon has been removed.

Colposcope – a lighted magnifying instrument used to examine the vagina and cervix.

Colposcopy – examination of the vagina and cervix using a colposcope.

Common bile duct – a tube that is part of the biliary duct system and carries bile from the liver and the gallbladder through the pancreas and into the duodenum (the upper part of the small intestine). It is formed where the ducts from the liver and gallbladder are joined.

Complementary and alternative medicine – forms of treatment, that may include dietary supplements, megadose vitamins, herbal preparations, special teas, acupuncture, massage therapy, magnet therapy, spiritual healing, and meditation, that are used in addition to or instead of standard treatments. These practices generally are not considered standard medical approaches. Standard treatments go through an in-depth research process to prove they are safe and effective, but less is known about most types of alternative medicine practices.

Complete (total) hysterectomy – surgery to remove the entire uterus, including the cervix

Compression garment – a tight-fitting, elastic garment, such as a sleeve or stocking. Compression garments are used in the treatment of lymphedema and used to improve blood flow.

Congestive heart failure - is a chronic progressive condition that affects the pumping power of your heart muscles. While often referred to simply as "heart failure," CHF specifically refers to the stage in which fluid builds up around the heart and causes it to pump inefficiently.

Conization – surgery to remove a cone-shaped piece of tissue from the cervix and cervical canal.

Connective tissue – supporting tissue that surrounds other tissues and organs.

Conservative surgical excision – surgery to remove the cancer and a margin of normal tissue less than 2 centimeters.

Constipation – a condition in which stool becomes hard, dry, and difficult to pass, and bowel movements don't happen very often. Painful bowel movements, feeling bloated, uncomfortable, and sluggish are among the other side-effects.

Continent urostomy – another type of urostomy is the continent diversion. Here, the pouch created from the piece of intestine has a valve created. The valve allows the urine to be stored in the pouch and emptied several times each day by placing a drainage tube (catheter) into the hole. Some clients prefer this because there is no bag on the outside.

Contracture – a permanent tightening of the muscles, tendons, skin, and nearby tissues that causes the joints to shorten and become very stiff. This may prevent normal movement of a joint or other body part. Contractures may be caused by injury, scarring, and nerve damage, or by not using the muscles (i.e.; frozen shoulder). It may also occur at some point in time after a stem cell transplant that caused chronic graft-versus-host disease. It is also one of the side-effects following breast reconstruction with implants.

Contraindication – a symptom or medical condition that makes a particular treatment or procedure inadvisable because a person is likely to have a bad reaction. For example, having high blood pressure is a contraindication for performing isometric exercises.

Contralateral – having to do with the opposite side of the body.

Conventional (clear cell) – a type of renal cortical kidney cancer which accounts for 6065% of cases.

Conventional medicine – a system in which medical doctors and other healthcare professionals treat symptoms and diseases using drugs, radiation, or surgery.

Cordectomy – an operation on the vocal cords or on the spinal cord.

Core – the center of the body and the beginning point of movement. The lumbo-pelvic-hip complex.

Core biopsy – the removal of a tissue sample with a wide needle for examination under a microscope.

Core needle biopsy – the removal of a tissue sample with a wide needle for examination under a microscope.

Core stability – neuromuscular efficiency of the lumbo-pelvic-hip complex.

Core strength – the ability of the lumbo-pelvic-hip complex to control and individual's changing center of gravity.

Coronal (Frontal) plane – this plane bisects the body into its' front and back halves. Joint motion in this plane occurs around an anterior/posterior axis and includes abduction and adduction of the limbs, lateral flexion of the spine, and eversion and inversion of the foot.

Corticosteroids – reduce inflammation.

Cosmesis - is the preservation, restoration, or bestowing of bodily beauty. In the medical context, it usually refers to the surgical correction of a disfiguring defect, or the cosmetic improvements made by a surgeon following incisions.

Cranial nerve palsy – is a type of muscle malfunction involving at least one of the cranial nerves. Cranial nerve palsies are usually very easy to identify because they involve the muscles of the face, and people's faces change as a result of the palsy. A patient may find it difficult to smile, to control eye movements, and to engage in other facial expressions.

Craniopharyngioma – is a benign tumor that occurs most often in children and adolescents than in adults. It develops near the optic nerve and the pituitary gland. It may bring on visual impairment and hormonal imbalances. It may also affect the hypothalamus, the part of the brain that regulates temperature, hunger, and thirst.

Craniospinal radiation – if tests find that a brain tumor has spread along the covering of the spinal cord (meninges), or into the surrounding cerebrospinal fluid, then radiation may be given to the whole brain and spinal cord.

Craniotomy – an operation in which an opening is made in the skull. A plate of bone is removed, and the skin is pulled back to expose the brains surface.

Cruciferous vegetable – a member of the family of vegetables that includes broccoli, Brussels sprouts, cabbage, cauliflower, collard greens, kale, and turnips. These vegetables contain substances that may protect against cancer.

Cryoablation – a procedure in which tissue is frozen to destroy abnormal cells. Liquid nitrogen or liquid carbon dioxide is used to freeze the tissue.

Cryotherapy – any method that uses cold temperature to treat disease.

CT scan – a series of detailed pictures of areas inside the body taken from different angles. The pictures are created by a computer linked to an x-ray machine.

Cure – a treatment to restore health.

Curettage – removal of tissue with a curette (a spoon-shaped instrument with a sharp edge).

Curette – a spoon-shaped instrument with a sharp edge.

Cushing's syndrome - results from high levels of the hormone cortisol in the body. The rise in hormone levels could be due to body's increased production of cortisol or overuse of corticosteroids. Notable symptoms include hump between the shoulders, round face, and purple stretch marks on the skin. Treatment includes reducing steroid usage, surgery, radiation therapy and medications.

Cyanosis – bluish discoloration, especially of the skin and mucous membranes, due to excessive concentration of deoxyhemoglobin in the blood caused by deoxygenation.

Cylophosphamide – also known as cytophosphane, is a medication used as chemotherapy and to suppress the immune system.

Cyclosporine – is an immunosuppressant that produces some tendency to develop high blood pressure, kidney and liver problems, tremors or shaking, headache or body pain, diarrhea, constipation, vomiting, numbness, and the growth of body hair.

Cytokine – a substance that is made by cells of the immune system. Some cytokines can boost the immune response and others can suppress it. Cytokines can also be made in the laboratory by recombinant DNA technology and used in the treatment of various diseases, including cancer.

Cytopenia – a condition in which there is a lower-than-normal number of blood cells.

D&C (dilation and curettage) – a procedure to remove tissue from the cervical canal or the inner lining of the uterus.

DCIS (ductal carcinoma in situ) – a noninvasive condition in which abnormal cells are found in the lining of a breast duct. The abnormal cells have not spread outside the duct to other tissues in the breast.

Dacron cuff - a sheath of Dacron surrounding an atrial or venous catheter to prevent accidental displacement.

Debulking – surgical removal of as much of a tumor as possible. Debulking may increase the chance that chemotherapy or radiation therapy will kill all the tumor cells. It may also be done to relieve symptoms or help the patient live longer.

Deep vein thrombosis (DVT) - occurs when a blood clot (thrombus) forms in one or more of the deep veins in your body, usually in your legs. Deep vein thrombosis can cause leg pain or swelling, but also can occur with no symptoms. It can be very serious because blood clots in your veins can break loose, travel through your bloodstream and lodge in your lungs, blocking blood flow (pulmonary embolism).

Degenerative disease – a disease in which the function or structure of the affected tissues or organs changes for the worse over time. Dehydration – a condition caused by the loss of too much water from the body. Severe diarrhea or vomiting can cause dehydration.

Dendritic cells (DCs) - are antigen-presenting cells (also known as accessory cells) of the immune system. Their main function is to process antigen material and present it on the cell surface to the T cells of the immune system. They act as messengers between the innate and the adaptive immune systems.

Depression – a mental condition marked by ongoing feelings of sadness, despair, loss of energy, and difficulty dealing with normal daily life. Depression affects 15-25% of cancer clients.

Dermabrasion – removal of the top layer of skin using a rotating wheel or small particles to rub away

Desmoplastic small round cell tumor – is a rare sarcoma of adolescents and young adults, found most often in the abdomen.

Diabetes – usually refers to diabetes mellitus (Type I) in which there is also a high level of glucose in the blood because the body does not make enough insulin or use it the way it should. There is also Type II (adult onset diabetes) which can usually be managed with diet and exercise.

Diagnostic test – a type of test used to help diagnose a disease or condition.

Diagnostic trial – a research study that evaluates methods of detecting disease.

Dialysis – the process of filtering the blood when the kidneys are not able to cleanse it.

Diaphragm – the thin muscle below the lungs and heart that separates the chest from the abdomen.

Diarrhea – frequent and watery bowel movements.

DIEP flap – a muscle conserving type of breast reconstruction in which blood vessels (deep inferior epigastric perforators), as well as ski, fat, and tissue are removed from the lower abdomen and used for reconstruction. This procedure does not compromise abdominal and core strength because the rectus muscles are left in place.

Diet – the things that a person or animal eats and drinks or the act of restricting caloric consumption.

Dietitian (nutritionist) – a healthcare professional with training in nutrition who can help with dietary choices for health and weight loss purposes.

Differentiation – when used to describe cancer, describes how much or how little tumor tissue looks like the healthy tissue it came from. Well-differentiated cancer cells look like normal cells and tend to grow and spread more slowly than poorly differentiated cells. This is used for tumor grading and diagnostic purposes.

Digestive system – the system is made up of the series of organs (salivary glands, mouth, esophagus, stomach, liver, pancreas, gallbladder, small and large intestines, and rectum) and works together to make food absorbable in the body.

Digestive tract – the series of organs (mouth, esophagus, stomach, small and large intestines, and rectum and anus) through which food and liquids pass, nutrients are absorbed, and waste is eliminated.

Dilatation and curettage (D&C) – a procedure to remove tissue from the cervical canal or the inner lining of the uterus. The cervix is made larger by dilating it a sharp spoonshaped instrument called a curette is inserted into the uterus to remove tissue.

Dilated cardiomyopathy – a condition that develops when the ventricles enlarge and weaken. Over time, this can cause the heart to lose its' ability to pump blood effectively.

Diplopia – double vision.

Disorder – a disturbance of normal functioning of the mind or body. Can also refer to the lack of order.

Disorientation – loss of one's sense of direction, position, or relationship with one's surroundings.

Diuretics – remove excess sodium from the body and reduce the amount of fluid in the blood

Dysplasia – abnormal cell growth

Disseminate – to scatter or distribute over a large area or range. To spread throughout an organ of the body.

Distal pancreatectomy – the removal of the body and tail of the pancreas.

Distant cancer (distant metastasis) – refers to cancer that has spread (metastasized) from the primary tumor to distant organs or lymph nodes.

Donor – a person who gives blood, cells, tissue, semen, eggs, or an organ for use in another person, such as in a blood transfusion or an organ transplant. It could also be someone who is philanthropic and donates something to a cause.

Dorsal – the opposite of ventral. Refers to a position on or towards the back of the body.

Dose – quantity of medicine taken, or radiation given, at a particular time.

Ductal carcinoma – the most common type of breast cancer. It is also known as DCIS and it is 97% curable. In situ means contained. It has not spread beyond the lining of the breast duct. It is a noninvasive condition in which abnormal cells are found in the lining of a breast duct.

Dumping syndrome – occurs when food, especially sugar, moves too fast from the stomach to the duodenum - the first part of the small intestine - in the upper gastrointestinal (GI) tract. This condition is also called rapid gastric emptying. With most, or all the stomach missing, the food spills into the intestine too rapidly. In late dumping syndrome the small intestine is forced to absorb larger amounts of food than normal, driving up the concentration of sugar in the circulation. The pancreas produces excess insulin to regulate the blood glucose level. Clients may feel weak or tired several hours after eating from a drop in blood sugar. They may also have a headache, sweating, anxiety, and/or tremors. Early dumping syndrome can take place several minutes after eating. Blood pressure increases, but blood flow to the intestine decreases, Symptoms include an irregular or rapid heartbeat, dizziness, shortness of breath, flushed skin, vomiting, abdominal cramps, and diarrhea. The smaller the remaining stomach, the worse the symptoms. The symptoms usually subside within 3-12 months, but in some clients the condition may become chronic. Clients can control their symptoms by eating frequent, smaller meals, low in carbohydrates. Fluids should be consumed between meals rather than accompanying them.

Duodenum – the first part of the small intestine between the stomach and the middle part of the small intestine (jejunum). After foods mix with stomach acid, they move into the duodenum, where they mix with bile from the gallbladder and digestive juices from the pancreas. Absorption of vitamins, minerals, and other nutrients begins in the duodenum.

Dura matter (Dura) – the outermost of the three layers of the meninges surrounding the brain and spinal cord.

Dysarthria - difficult or unclear articulation of speech that is otherwise linguistically normal.

Dysesthesias - comes from the Greek word "dys," meaning "not-normal," and "aesthesis," which means "sensation" (abnormal sensation). It is defined as an unpleasant, abnormal sense of touch. It often presents as pain but may also present as an inappropriate, but not discomforting, sensation.

Dysphagia – is the medical term for the symptom of difficulty in swallowing.

Dysplasia – abnormal development or growth of tissues, organs, or cells. Although cells make look abnormal under a microscope, they are not cancer.

Dyspnea – difficult, painful breathing or shortness of breath. In 85% of cases it is due to either asthma, pneumonia, cardiac ischemia, interstitial lung disease, congestive heart failure, chronic obstructive pulmonary disease, or psychogenic causes.

DYSURIA - is a symptom of pain, discomfort, or burning when urinating.

Early menopause – a condition in which the ovaries stop working and menstrual periods stop before age 40. The usual onset for natural menopause is 51. A woman is said to be in menopause when she hasn't had a period for 12 months in a row. Symptoms of menopause include hot flashes, mood swings, night sweats, vaginal dryness, trouble concentrating, decrease sexual desire, weight gain, osteoporosis, and infertility. Induced menopause, such as occurs when the ovaries are damaged by radiation, chemotherapy or other medications; or as occurs when the ovaries are surgically removed (by bilateral oophorectomy

Early-stage breast cancer – breast cancer that has not spread beyond the breast or to the nearby axillary lymph nodes. This includes ductal carcinoma in situ and stage I, stage IIA, stage IIB, and stage IIIA breast cancer.

Early-stage cancer – a term used to describe cancer that is early in its growth, and may not have spread to other parts of the body. This may vary amongst cancer types.

Edema – abnormal pooling of fluid in tissues or the accumulation of excess interstitial fluids. It is not the same as lymphedema in which lymph collects in the soft tissues because of damage to the lymphatic system.

Efferent neurons – neurons that transmit nerve impulses from the brain and/or spinal cord to the muscles and glands. Also known as motor neurons.

Efficacy – the capacity to produce an effect. In medicine, the ability of an intervention (treatment, surgery, medical device, etc.) to produce the desired change.

EGFR – a genetic mutation that is regularly tested for in lung cancer clients is a gene called EGFR, or epidermal growth factor receptor (this helps the cells divide). It is mutated in about 10% of clients with non-small cell lung cancer and in nearly 50% of lung cancers arising in those who have never smoked.

Electrodessication (electrosurgery) – destroys tissue by a using a high-frequency electric current applied with a needle-shaped electrode.

Electrofulguration – a procedure where a high-energy laser beam is used to destroy tissue.

Electrolarynx – a battery-operated device which is hand held and placed under the mandible producing a vibration to allow speech. It is used to help a person speak after a laryngectomy.

Electrolyte – are minerals in your blood and other body fluids that carry an electric charge. The primary ions of electrolytes are sodium, potassium, calcium, magnesium, and chloride. Sodium is the main electrolyte found in extracellular fluid and is involved in fluid balance and blood pressure control. Muscle contraction is dependent upon the presence of calcium, sodium, and potassium. Without sufficient levels of these key electrolytes, muscle weakness or severe muscle contractions may occur

Embolization – is a non-surgical minimally invasive procedure that blocks an artery with a clot or foreign material. The purpose of embolization is to prevent blood flow to an area of the body, which can potentially shrink a tumor.

Embryonal carcinomas – a type of non-seminoma that's partially present in about 40% of testicular tumors, but pure embryonal carcinomas occur only 3% to 4% of the time.
When seen under a microscope, these tumors can look like tissues of very early embryos. These tumors tend to grow rapidly and metastasize outside the testicle.

EML4-ALK – clients whose tumors do not have mutations in either EGFR or KRAS may have another abnormality called EML4-ALK. Clients will be tested for certain cell proteins and those with these proteins in their tumors may be less likely to benefit from traditional chemotherapy given after initial treatment (adjuvant).

Endocarditis – inflammation of the inside lining of the heart chambers and heart valves (endocardium).

Endocrine system – a system of glands, each of which secretes different types of hormones that are released directly into the blood stream. The endocrine system controls metabolism, growth and development, sexual development, sleep, hunger, tissue function, and mood.

Endocrinologists - specially trained physicians who diagnose diseases related to the glands.

Endoluminal laser therapy – the tumor is reduced with a laser attached to an endoscope that is inserted through an incision in the abdomen.

Endoluminal stent placement – a thin, flexible tube (stent) is placed between the stomach and small intestine or the stomach and the esophagus to create a clear passageway for food.

Endometrial – having to do with the endometrium (the membrane lining the uterus).

Endometrial biopsy – a doctor takes a sample of tissue from the endometrium for examination. It is looked at under a microscope for the presence of abnormal cells. This is done by inserting a thin tube through the cervix into the uterus, and gently scraping (while simultaneously suctioning) to remove the sample.

Endometrial cancer – cancer that starts in the endometrium.

Endometrial hyperplasia – an overgrowth of the endometrial cells that result in a thickening of the lining of the uterus. It is usually not cancer but can lead to it.

Endorphin – are among the brain chemicals known as neurotransmitters. They are produced by the pituitary gland and hypothalamus during exercise, excitement, pain, orgasm, the consumption of spicy food, and love. Endorphins are small proteins known as peptides that bind to opioid receptors in the central nervous system and produce an analgesic effect.

Endoscope – a device with a light attached to it, a lens for viewing, and possibly a tool to remove tissue as well.

Endoscopic mucosal resection – the cancer is removed through an endoscope that's passed down the throat to the stomach. It is only done for cancers at a very early stage in which the risk spread to the lymph nodes is very unlikely.

Endoscopy – a procedure that lets a doctor look inside the body using an endoscope to examine the inside of the body.

Enucleation – a laparoscopic surgical procedure to remove a small pancreatic tumor without removing any other tissue.

Ependymomas – occur in the ependymal cells found in the lining of the brain's hollow cavities and the central canal of the spinal cord. Eighty-five percent of these tumors are benign, but the malignant form of these tumors has a greater likelihood of spreading up and down the spine via the spinal fluid.

Epidermis – is composed of the outermost layer of the skin.

Epidural – an injection into the dura mater (epidural space) that is between the wall of the spinal canal and the covering of the spinal cord.

Epidural spinal cord compression – is metastasis of cancer into the spine or epidural space that causes secondary compression of the spinal cord.

Epigenetics - is the study, in the field of genetics, of cellular and physiological phenotypic trait variations that are caused by external or environmental factors that switch genes on and off and affect how cells read genes instead of being caused by changes in the DNA sequence.

Epiglottis – the flap of cartilage that sits at the base of the tongue and covers the trachea (windpipe) during swallowing so that food does not enter the lungs.

Epithelial – refers to the cells that line the cavities and surfaces of the body. They also form many glands.

Epithelioid sarcoma – most often develops in tissues under the skin of the hands, forearms, feet, or lower legs. Adolescents and young adults are often affected.

Erectile dysfunction (impotence) – the inability to have or maintain an erection of the penis sexual intercourse. Also called impotence.

Erection – a physiological phenomenon in which the penis swells with blood, causing it to become firm, enlarged, and engorged.
Erythrocyte (red blood cell) – the most common type of blood cells in the body. They carry oxygen to all parts of the body.

Esophageal – having to do with the esophagus, the muscular membranous tube for the passage of food from the pharynx (throat) to the stomach.

Esophageal cancer – cancer that forms in tissues lining the esophagus.

Esophageal stent – a tiny tube placed at a point of narrowing or blockage in the esophagus, to keep it open so the patient can swallow soft food and liquids.

Esophageal stricture - describes a narrowing or tightening of the esophagus. It typically occurs when stomach acid and other irritants damage the lining of the esophagus over time. This leads to inflammation (esophagitis) and scar tissue, which causes the esophagus to narrow.

Esophagectomy – surgery to remove all or part of the esophagus.

Esophogoscopy – endoscopic examination of the esophagus using an esophagoscope (a thin, tube-like instrument with a light and a lens for viewing) inserted through the mouth. Esophogoscopy alone is uncommon. It is generally performed as part of a more complex upper endoscopic procedure in which the esophagus, stomach, and portions of the small intestine are explored endoscopically.

Estrogen – a generic term for estrus-producing compounds (the female sex hormones), including estradiol, estriol, and estrone. The estrogens are formed in the ovaries, adrenal cortex, testis, and fetoplacental unit. They help develop and maintain female sex characteristics and the growth of long bones. Estrogens can also be made in the laboratory and may be used as a type of birth control, to treat symptoms of menopause and menstrual disorders, osteoporosis, and to improve breast and prostate cancer.

Estrogen blocker (aromatase inhibitors) – are sometimes referred to as anti-estrogens. Estrogen blockers lower estrogen levels in the body and prevent testosterone, which both men and women have, from converting into estrogen

Estrogen receptor – are a group of proteins found in cells and they are receptors that are activated by the hormone estrogen. In women who are found to be "estrogen receptor positive," the overwhelming concern is that they may cause the cells to proliferate.

Estrogen receptor negative – breast cancer cells without a receptor to which estrogens can attach; this is associated with a poorer prognosis as they usually don't respond to antiestrogen therapy.

Estrogen receptor positive – breast cancer cells with a receptor to which estrogens can attach; these cancer cells may grow in the presence of estrogen and may stop growing or die when treated with estrogen blockers.

Estrogen receptor test – a laboratory test to find out if cancer cells have estrogen receptors.

Estrogen replacement therapy – medications containing female hormones to replace the ones the body no longer makes after menopause.

Evoked potential electrophysiological mapping – during surgery, small electrodes are used to stimulate nerves and measure their electrical responses, or evoked potential. By establishing the function of specific nerves in each patient, the surgeon can identify the critical areas of the brain to avoid.

Ewing's sarcoma – is a tumor of the bone which affects children and young adults. It differs from osteosarcoma in that it tends to be found in bones such as ribs rather than the long bones of the arm and leg. It is uncommon before age 5 and after age 30. It may involve any part of the bony skeleton and may extend into the soft tissue around the bones. Fever, chills and weakness, intermittent pain, and swelling are initial symptoms. When the tumor is found outside the bones, it is known as "soft-tissue" or extra-osseous Ewing's sarcoma. For many years Ewing's sarcoma was considered fatal, but with present treatment methods it is highly treatable and, in many cases, curable. The most curable cases are those found in the lower jaw, skull, face, scapula, vertebra or clavicle, and those below the elbow or knee. Ewing's sarcoma typically affects the same age group as osteosarcoma; 10-25 years of age.

Excision – removal by cutting. In surgery, the complete removal of an organ, tissue, bone or tumor from a body

Excisional biopsy – a surgical procedure in which the entire abnormal area is removed as well as an additional layer of tissue. The tissue is sent to pathology and examined under a microscope.

Exenteration – surgical removal of all the contents of a body cavity.

Exocrine pancreas cell – a cell in the pancreas that produces enzymes which are secreted into the small intestine. These enzymes help digest food as it passes through the gastrointestinal tract.

Extended resection – a reconstructive procedure after part of chest wall, left atrium, and diaphragm are removed. May require a muscle flap for structural stability. It may be from the serratus anterior, pectoralis major, latissimus dorsi or rectus abdominis. Muscle imbalances will need to be addressed depending on where the flap was taken from.

Extension – the opposite of flexion. A straightening movement in which the relative joint angle between two adjacent segments increases.

Externally rotated – pointing outward.

External radiation therapy – is a method for delivering a beam, or several beams, of high-energy x-rays to a patient's tumor/tumor site. These high energy x-rays deposit a lethal dose of radiation to the area of the tumor to destroy the cancer cells while sparing the surrounding normal tissues. No radioactive sources are placed inside the patient's body.

Extremity – the furthest point or limit of something. In anatomy, a limb of the body; such as the arm or leg.

FK-506 – is an immunosuppressant whose side effects include: infection, heart and lung damage, headaches, diarrhea, increased tension, nausea, blurred vision, diabetes, itching, liver and kidney dysfunction, loss of appetite, insomnia, confusion, weakness, depression, cramps, neuropathy, seizures, and tremors.

Fallopian tube – two very fine tubes in a women's body that allow eggs to pass from an ovary to the uterus.

False-negative test result – a test result that appears negative when it is not.

False-positive test result – a test result that appears positive when it is not.

Family medical history – a record of illnesses and medical conditions affecting your family. It may show a pattern of certain diseases amongst family members.

Fanconi syndrome – is a disease of the proximal renal tubules[1] of the kidney in which glucose, amino acids, uric acid, phosphate and bicarbonate are passed into the urine, instead of being reabsorbed. Fanconi syndrome affects the proximal tubule, which is the first part of the tubule to process fluid after it is filtered through the glomerulus.

Fascia – a structure of connective tissue that surrounds muscles, groups of muscles, blood vessels, and nerves, binding some structures together, while permitting others to slide smoothly over each other .

Fat necrosis – is a lump that forms in the breast due to fat cells that have either been damaged or degenerated. It is caused by trauma to the breast. Many times the lump will form with a bruising or redness around it. It is common for clients who have recently undergone east surgery or radiation to develop breast necrosis.

Fatigue – a condition that is marked by extreme tiredness and the inability to focus, function, and perform activities of daily living due to lack of energy. Fatigue may be acute or chronic. It is reported by 76% of cancer clients.

Fertility – the natural capability to produce offspring.
Fertility preservation – an effort to help cancer clients retain their fertility.

Fibrolamellar HCC - is a rare subtype that often has a higher chance for successful treatment than other types of liver cancer.

Fibromyxoid sarcoma, low-grade – is a slow growing cancer that most often develops as a painless growth in the trunk or arms and legs (particularly the thigh). It is more common in young to middle aged adults. It is also sometimes called an Evans' tumor.

Fibrosarcoma – this is a very rare form of bone cancer which may occur at any age but is rare in children. Fibrosarcomas may develop in persons who have had radiation or at the site of a past bone fracture. It is also felt that Paget's disease (for unknown reasons, parts of the skeleton become overactive and dismantle simultaneously rebuild themselves at an abnormally fast rate) may be a predisposing factor in the development of fibrosarcoma.

Fine-needle aspiration biopsy – a diagnostic procedure in which tissue or fluid is removed with a thin needle for examination under a microscope.

First-line (induction) therapy – is usually the standard initial treatment used to reduce or manage cancer. It is followed by other treatments including radiation therapy, chemotherapy, and hormonal therapy.

Fistula – is an abnormal connection between an organ, vessel, or intestine and another structure.

Five-year survival rate – a term that is used in medicine for estimating the prognosis of a disease. It refers to the percentage of people who are alive, five years after their initial diagnosis.

Flexibility – the ability to have optimum range of motion (ROM) as well as neuromuscular control throughout a specific ROM in order to prevent injury and enhance performance.

Flexion – the opposite of extension. The relative angle between two adjacent segments decreases.

Fluoroscopy - is an imaging technique that uses X-rays to obtain real-time moving images of the interior of an object.

Follicular thyroid cancer – accounts for 50% of thyroid cancers and are most common in women over 50 years old. It grows slowly and is highly treatable.

Force production – the force generated by a muscle action.

Fulguration – the destruction of tissue, usually malignant tumors, by means of a high-frequency electric current applied with a needlelike electrode.

Functional image-guided surgery – this procedure is carried out prior to brain surgery, during a special MRI scan. The patient is asked to perform certain repetitive activities. The parts of the brain that are responsible for those functions will demonstrate heightened activity, which the scan will convert to an image. The neurosurgeon will have a map that will direct him to the mass and around sensitive areas.

Fusion (arthrodesis) – a reconstructive procedure to replace a limb that may result in a stiff joint but permits activities such as running and jumping.

Gallium scan – a small amount of radioactive material, gallium, is injected into a vein. It travels through the bloodstream and into the body's tissues, primarily the bones, liver, intestine, and areas of tissue where inflammation or a buildup of white blood cells is present. It often takes a few days to build up in these areas, so a scan is usually done at 2 days and again at 3 days after the tracer is injected. Areas where there is noticeable build up show up as bright or "hot" spots in the pictures. The problem areas may be caused by infection, certain inflammatory diseases, or a tumor.

Gamma Knife therapy (radiosurgery) – directs highly focused beams of ionizing radiation with high extreme precision to the tumor site. It is a relatively recent technique used to destroy intracranial and extracranial tumors and other lesions that are otherwise inaccessible for open surgery.

Gangliomas - contain both neurons and glial cells. These tumors are very uncommon in adults. They are typically slow growing (grade II) tumors and can usually be cured by surgery alone or surgery combined with radiation therapy

Gardner syndrome (familial colorectal polyposis) - is a subtype of Familial Adenomatous Polyposis (FAP). Gardner syndrome is an autosomal dominant form of polyposis characterized by the presence of multiple polyps in the colon together with tumors outside the colon.

Gastrectomy – an operation to remove all or part of the stomach.

Gastric – having to do with the stomach.

Gastric (stomach) cancer – cancer that forms in tissues lining the stomach.

Gastric Bypass – if the tumor is blocking the flow of food from the stomach, the stomach may be sewn directly to the small intestine so the patient can continue to eat normally.

Gastric feeding tube (gastrostomy tube) – is a medical device used to provide nutrition to clients who cannot obtain nutrition by swallowing. The state of being fed by a feeding tube is called gavage, enteral feeding or tube feeding. Placement may be temporary for the treatment of acute conditions or lifelong in the case of chronic disabilities.

Gastric pull-up – replaces the throat and the entire esophagus by taking the "J" shaped part of the stomach and attaching it to the pharynx.

Gastroduodenostomy – connecting what remains of the stomach to the duodenum.

Gastrojejunostomy – connecting what remains of the stomach to the jejunum.

Gastroesophageal junction – the place where the esophagus is connected to the stomach.

Gastrointestinal – refers to the stomach and intestines and sometimes includes everything from the mouth to the anus.

Gastrointestinal stromal tumor (GIST) – This is a type of sarcoma that develops in the digestive tract. It is covered in Gastrointestinal Stromal Tumor (GIST).

Gene – a molecular unit of heredity passed from parent to offspring. A gene is any section along the DNA that has instructions encoded that allow a cell to produce a specific product – usually, a protein, such as an enzyme – that triggers one precise action. There are between 50,000 and 100,000 genes, and every single gene is made up of thousands, even hundreds of thousands, of chemical bases.

Gene expression – the process by which a gene gets turned on in a cell to make RNA and proteins. Gene expression may be measured by looking at the RNA, or the protein made from the RNA, or what the protein does in a cell.

Gene expression profile – is the measurement of the activity of thousands of genes at once, to create a picture of cellular function. These profiles can, for example, distinguish between cells that are actively dividing, or show how the cells react to a particular treatment

Genetic marker of susceptibility – a specific change in a person's DNA that makes the person more likely to develop certain diseases such as cancer.

Genetic predisposition – an inherited increase in the risk of developing a disease. Also called genetic susceptibility.

GENITOURINARY - is a word that refers to the urinary and genital organs.

Germ cell tumors – more than 90% of cancers of the testicle develop in germ cells (these are the cells that produce sperm). There are 2 main types of germ cell tumors: seminomas and non-seminomas.

Gerota's fascia – a fibrous envelope of tissue that surrounds the kidney.

Gingival hypertrophy – increase in the size or gums

Glaucoma - is a group of diseases that damage the eye's optic nerve and can result in vision loss and blindness.

Glioma – about 3 out of 10 brain cell tumors are gliomas. They are a cancer of the brain that begins in glial cells (cells that surround and support nerve cells).

Glomerular injury – an injury relating to a cluster of nerve endings, spores, or small blood vessels, especially around the end of a kidney tubule.

Glossectomy – surgical removal of all the tongue.
Glottis – the middle part of the larynx; the area where the vocal cords are located.

Glucagon – a hormone produced by the pancreas that increases the level of glucose (sugar) in the blood.

Glucose – a type of sugar; the chief source of energy for living organisms.

Glycemia – glucose (sugar) found in the blood. Also called blood sugar.

Glycemic index – a measure of the increase in the level of blood glucose caused by eating a specific carbohydrate. Foods with a high glycemic index release glucose quickly and cause a rapid rise in blood sugar. Foods with a low glycemic index release sugar slowly into the blood.

Goniometer – an instrument used for measuring angles.

Grading – a system for classifying cancer cells in terms of how abnormal they appear when examined under a microscope. The objective of a grading system is to provide information about the probable growth rate of the tumor and its tendency to spread. The systems used to grade tumors vary with each type of cancer. Grading plays a role in treatment decisions.

Graft – healthy skin, bone, or other tissue taken from one part of the body and used to replace diseased or injured tissue removed from another part of the body.

Graft-versus-host disease (GVHD) – is a common complication following an allogeneic tissue transplant. It is commonly associated with stem cell or bone marrow transplant but may also apply to other forms of tissue graft. White blood cells in the graft recognize the host as "foreign". The transplanted immune cells then attack the host's own body cells. GVHD can also occur after a blood transfusion if the blood products used have not been irradiated

Graft-versus-tumor effect - appears after allogeneic hematopoietic stem cell transplantation. The graft contains donor T cells that can be beneficial for the recipient by eliminating residual malignant cells. GvT might develop after recognizing tumor-specific or recipient-specific alloantigens.

Groin – the crease or hollow where the inner part of each thigh meets with the trunk, together with the adjacent region and often including the external genitals.

Gynecologic – having to do with the female reproductive organs.

Gynecologic cancer – cancer of the female reproductive organs. This may include any of the following: the cervix, endometrium, fallopian tubes, ovaries, uterus, and/or vagina.

HLRCC – is a relatively rare, inherited known form of kidney cancer that is difficult to diagnose before surgery in clients without a known family history of the disease. Genetic testing is available for individuals suspected of having the syndrome.

Hallucination – the perception of visual, auditory, or tactile experiences without an external stimulus. The person has a compelling sense of their reality. Hallucinations can be caused by nervous system disease, certain drugs, or mental disorders.

Halsted radical mastectomy – surgery for breast cancer in which the breast, pectoralis major and minor, and all of the lymph nodes under the arm are removed. It is rarely, if ever, used anymore in the U.S. Doctors consider radical mastectomy only when the tumor has spread to the chest muscles.

Hand-foot syndrome – also called Palmar-Plantar Erythrodysesthesia, is a side effect which can occur with several types of chemotherapy or biologic therapy drugs used to treat cancer. It is marked by pain, swelling, numbness, tingling, or redness of the hands or feet.

Heart failure – is a condition in which the heart cannot pump enough blood to the rest of the body

Hemangiosarcoma – originates in the blood vessels and is found in the arms, legs, and trunk.

Hematocrit – the percentage by volume of red blood cells in a given sample of blood after it has been spun in a centrifuge. Results are used to check for conditions such as anemia, dehydration, malnutrition, and leukemia.

Hematomegaly - abnormal enlargement of the liver.

Hematopoiesis - new blood cell formation

Hematuria - is the presence of blood in a person's urine.

Hemiparesis - is partial weakness on one side of the body.

Hemodynamic compromise – "blood flow compromise", which is anything that may prevent proper blood flow such as a hemorrhage, plaque atherosclerosis, etc.

Hemoglobin – a protein in red blood cells that carries oxygen from the respiratory organs to tissues and organs in the body and carries carbon dioxide back to the lungs. Results are used to check for conditions such as anemia, dehydration, and malnutrition.

Hemorrhage – the escape of blood from the blood vessels. A hemorrhage may be internal or external, and usually involves excessive bleeding in a short period of time.

Hemorrhagic cystitis - is an inflammation of the bladder defined by lower urinary tract symptoms that include dysuria, hematuria, and hemorrhage. The disease can occur as a complication of cyclophosphamide, ifosfamide and radiation therapy.

Hepatectomy – surgery to remove all the liver.

Hepatic – referring to the liver.

Hepatic fibrosis - is overly exuberant wound healing in which excessive connective tissue builds up in the liver. The extracellular matrix is overproduced, degraded deficiently, or both. The trigger is chronic injury, especially if there is an inflammatory component. Hepatic veno-occlusive disease (VOD) – is a serious problem in which blood flow inside the liver is blocked. It only happens in people with allogeneic transplants, and mainly in those who received the drugs busulfan or melphalan as part of conditioning. It usually happens within 3 weeks of conditioning. VOD is more common in older people who had liver problems prior to the transplant, and in those with acute GVHD. It starts with jaundice, dark urine, tenderness below the right ribs, and rapid weight gain (mostly abdominal bloating).

Hepatoblastoma - is very rare type of liver cancer most often is found in children

Hepatocellular carcinoma (HCC) - make up most primary liver cancers. They begin in hepatocyte cells. Sometimes they begin as a single tumor; other times they start in multiple spots in the liver. The latter is more common in people with liver damage, such as cirrhosis.

Hepatomegaly – abnormal enlargement of the liver.

Hepatitis – a disease of the liver causing inflammation. It is accompanied by liver cell damage and death. It is caused most frequently by viral infection, but also certain drugs, chemicals, or poisons. Symptoms include an enlarged liver, fever, nausea, vomiting, jaundice, aching muscles, abdominal pain, and dark urine.

HER1 – the protein found on the surface of some cells and to which epidermal growth factor binds, causing the cells to divide. It is found in excessively high levels on the surface of many types of cancer cells. These cells may divide rapidly in the presence of epidermal growth factor.

HER2 positive – describes cancer cells that have too much of a protein called HER2 on their surface. When it is made in larger than normal amounts by cancer cells, the cells may grow more quickly and be more likely to metastasize to other parts of the body. Cancers that are HER2 positive may include breast, bladder, pancreatic, ovarian, and stomach cancers.

HER2/neu – a protein involved in normal cell growth that may be found on some types of cancer cells. Cancer cells removed from the body may be tested for the presence of HER2/neu to help decide the best treatment plan.

Herceptin – a type of monoclonal antibody used to treat breast cancer that is HER2positive. Herceptin binds to HER2 on the surface of HER2-positive cancer cells, and may kill them.

Hereditary – genetically transmitted from parent to offspring.
Hernia – the protrusion of an organ or the fascia of an organ through the wall of the cavity that holds it in place. Most hernias occur in the abdomen.

High blood pressure (hypertension) – a blood pressure of 140/90 or higher. Uncontrolled high blood pressure can harm the arteries and cause an increased risk of stroke, heart attack, kidney failure, and blindness.

High blood sugar (hyperglycemia) – higher than normal amount of glucose in the blood. High blood sugar can be a sign of diabetes or other conditions.

High grade (poorly differentiated) – a term used to describe cells that look abnormal under a microscope. These cells are typically fast-growing, have the tendency to metastasize, and are extremely aggressive.

High-dose chemotherapy – involves the administration of extremely high, potentially toxic doses of chemotherapy, in an effort to eradicate cancer cells. It is usually followed by bone marrow or stem cell transplantation to rebuild the bone marrow.

High-dose radiation – an amount of radiation that is greater than that given in typical radiation therapy. High-dose radiation is directed precisely at the tumor to avoid damaging the healthy surrounding tissue.

Hirsutism - results in excessive amounts of dark, course hair growth on women where men typically grow hair - face, chest and back.

Hodgkin lymphoma (Hodgkin disease) – a cancer originating from the white blood cells that is marked by the presence of a type of cell called the Reed-Sternberg cell. Hodgkin's lymphoma is characterized by the orderly spread of disease from one lymph node group to another.

Homeopathic medicine (Homeopathy) – an alternative medical system that was developed 200 years ago in Germany. Homeopathy is based on the idea that "like cures like." That is, if a substance causes a symptom in a healthy person, giving the person a very small amount of the same substance may cure the illness. In theory, a homeopathic dose enhances the body's normal healing and self-regulatory processes.

Homeostasis – is derived from the Greek, homeo or "same", and stasis or "stable" and means remaining stable or remaining the same. It is a state of balance among all the body systems needed for the body to survive and function correctly.

Horizontal (Transverse) Plane – this plane bisects the body into top and bottom halves. Joint motion in this plane occurs around a longitudinal or vertical axis and includes internal and external rotation of the limbs, right and left rotation for the head and trunk, and radioulnar pronation and supination. When referring to transverse plane motions of the foot, we use the terms abduction and adduction.

Hormonal therapy – treatment that adds, blocks, or removes hormones. For certain conditions (such as diabetes, thyroid disease, or menopause), hormones are given to adjust low hormone levels. To slow or stop the growth of certain cancers (such as prostate and breast cancer), synthetic hormones or other drugs may be given to block or destroy the body's natural hormones.

Hormone – a chemical released by a cell or gland in one part of the body that sends out messages that affect other cells in the body.
Hormone receptor – a molecule that can bind to a specific hormone.
Hormone receptor test – a test that will show whether or not an amount of certain proteins (hormone receptors) will fuel the growth of the tumor.

Hormone replacement therapy – hormones (estrogen, progesterone, or both) given to women after menopause to replace the hormones no longer produced by the ovaries.

HPV (human papillomavirus) – is the most common sexually transmitted virus in the U.S. There are more than 40 HPV types that can infect the genital areas of males and females. These HPV types can also infect the mouth and throat. It can cause abnormal tissue growth (warts) and other changes to cells. Infection for a long time with certain types of HPV can cause cervical cancer. HPV may also play a role in some other types of cancer, such as anal, vaginal, vulvar, penile, oropharyngeal, and squamous cell skin cancers.

Human microbiome - includes bacteria, archaea, fungi, protists and viruses. Though micro-animals can also live on the human body, they are typically excluded from this definition. The human microbiome refers specifically to the collective genomes of resident microorganisms.

Hydrocephalus – a serious condition that can result from the tumor impeding the normal flow of cerebrospinal fluid, causing it to build up and the brain to swell.

Hydrocortisone – a steroid hormone used to relieve the symptoms of certain hormone shortages and to suppress an immune response.

Hydronephrosis - is a condition that typically occurs when a kidney swells due to urine failing to properly drain from the kidney to the bladder. This swelling most commonly affects only one kidney, but it can involve both kidneys.

Hypercalcemia – higher than normal levels of calcium in the blood.

Hyperfractionated radiation therapy – radiation treatment in which the total dose of radiation is divided into small doses and treatments are given more than once a day.

Hyperphagia - is a medical term meaning excessive hunger and abnormally large intake of solids by mouth.

Hyperplasia – an abnormal increase in the number of normal cells in an organ or tissue.

Hypersensitivity – an exaggerated response by the immune system to a drug or other substance.

Hypertension (high blood pressure) – a blood pressure of 140/90 or higher.

Hyperthermia – abnormally high body temperature. This may be caused as part of treatment, by an infection, or by exposure to heat. Hyperthyroidism - too little thyroid hormone. Symptoms include weight loss, palpitations, tachycardia, heat intolerance, muscular weakness, and hyperphagia.

Hypertrophic cardiomyopathy (HCM) – is a condition in which the heart muscle becomes thick. Often, only one part of the heart is thicker than the other parts. The thickening can make it harder for blood to leave the heart, forcing the heart to work harder to pump blood

Hypertrophy – enhancement of skeletal muscle fibers in response to overcoming force from high volumes of tension.

Hypoglycemia – abnormally low blood sugar.

Hypomobility – restricted motion.

Hypopharyngeal cancer – cancer that forms in tissues of the hypopharynx (the bottom part of the throat).

Hypopharynx – the bottom part of the throat.

Hypophosphatemic rickets - is a disorder characterized by hypophosphatemia, defective intestinal absorption of calcium, and rickets or osteomalacia unresponsive to vitamin D. It is usually hereditary. Symptoms are bone pain, fractures, and growth abnormalities.

Hypothalamus – is the part of the brain that regulates temperature, hunger, and thirst.

Hypothyroidism – too little thyroid hormone. Symptoms include weight gain, constipation, dry skin, and sensitivity to the cold.

Hysterectomy – surgery to remove the uterus and, sometimes, the cervix. When the uterus and the cervix are removed, it is called a total hysterectomy. When only the uterus is removed, it is called a partial hysterectomy.

Ibuprofen – is a nonsteroidal anti-inflammatory drug (NSAID) used for relief of symptoms of arthritis, fever, as pain reliever, especially where there is an inflammatory component, and dysmenorrhea.

Ileostomy – is a surgical opening constructed by bringing the end or loop of small intestine (the ileum) out onto the surface of the skin. Intestinal waste passes out of the ileostomy and is collected in an external pouch.

Ilizarov apparatus - is a type of external fixation used in orthopedic surgery to lengthen or reshape limb bones; as a limb-sparing technique to treat complex and/or open bone fractures; and in cases of infected non-unions of bones that are not amenable with other techniques.

Image guided ablation – small needles are passed through the skin and x-rays are used to guide them into the cancer. These needles can then freeze (cryoablation) or boil (radiofrequency ablation) the cancer, eliminating the tumor. The body is then able to remove the dead tissue, leaving scar tissue behind in its place.

Image-guided radiation therapy – a procedure that uses a computer to create an image of the tumor to help guide the radiation beam during radiation therapy. The images are made using CT, ultrasound, X-ray, or other imaging techniques. Compared to external beam radiation therapy, it is more accurate and causes less damage to the surrounding healthy tissue.

Imagery (guided imagery) – a form of meditation in which a person focuses on positive images in their mind. It can help them relax, reduce stress, and provide a sense of wellbeing.

Immune checkpoint inhibitors - newer drugs, such as pembrolizumab (Keytruda) and nivolumab (Opdivo), that work by blocking checkpoints, which can boost the immune response against cancer cells.

Immune function – the state in which the body recognizes foreign materials and is able to neutralize them before they can do any harm.

Immune response – a response of the immune system to a foreign substance, including antibody production, cell-mediated immunity, and immunological tolerance.

Immune system – the complex system of cellular and molecular components that defend the body against infections and other diseases.

Immunity – the condition of being immune; protected against an infectious disease.

Immunization – a technique used to cause an immune response resulting in resistance to a specific disease.

Immunocompromised – having a weakened immune system caused by certain diseases or treatments.

Immunodeficiency – the body's ability to fight infections and other diseases is impaired.

Immunodeficiency syndrome – a syndrome associated with the body's inability to produce an immune response and an increased susceptibility to infection.

Immunosuppression – suppression of the body's immune response with drugs administered in preparation for bone marrow or other organ transplantation, to prevent rejection of the donor tissue. It may also result from AIDS, lymphoma, or from anticancer drugs.

Immunotherapy (biologic therapy) – a form of treatment that uses biologic agents to enhance or stimulate normal immune function. They may also be used to lessen certain side effects caused by some cancer treatments. Agents used in immunotherapy include monoclonal antibodies, growth factors, and vaccines.

Impairment – an abnormality or loss of a physical or mental ability as a result of injury or disease.

Implant – material inserted or grafted into an organ or structure of the body.

Impotence (erectile dysfunction) – the inability to achieve or maintain an erection of the penis adequate for sexual intercourse.

IMRT – a format for delivering high-dose radiation therapy using computer-generated images to show the exact location, shape, and size of the tumor, minimizing damage to surrounding healthy tissue.

Incisional biopsy – removal and examination of a lump or suspicious area. The tissue is then examined under a microscope to look for signs of disease and establish a precise prognosis.

Incontinence – inability to control excretory functions.

Indolent cancer – one that grows extremely slowly; sometimes taking 2-4 years to double in size.

Induction therapy (first-line therapy) – the first therapeutic measure used to treat a disease. It may be followed by other treatments, such as chemotherapy, radiation therapy, and hormone therapy to eradicate any remaining signs of the disease.

Infection – invasion and multiplication of microorganisms in the body. They can occur in any part of the body and can spread throughout the body. These bacteria, viruses, yeast, or fungi can cause a fever and other problems, depending on where the infection occurs. Under normal circumstances, the body's natural defense system is strong and can often fight the germs that lead to infection. Some cancer treatments cause immunocompromization, thereby weakening the body's natural defense system.

Inferior – the opposite of superior. A position below a specific reference point.

Inferior vena cava – the largest vein in the body. It returns deoxygenated blood to the heart from parts of the body below the diaphragm.

Infertility – the inability to produce children.

Infiltrating (invasive) breast cancer – cancer that has spread from its' point of origin in the breast into the surrounding, healthy tissue. Infiltrating breast cancer can spread to other parts of the body through the blood and lymphatic systems.

Infiltrating (invasive) cancer – cancer that has spread beyond its' point of origin and is growing into the surrounding, healthy tissues.

Infiltrating ductal carcinoma – the most common type of invasive breast cancer. It starts in the cells that line the milk ducts in the breast, grows outside the ducts, and often spreads to the lymph nodes.

Inflammation – a protective tissue response to injury or destruction of tissues, which serves to destroy, dilute, or wall off both the injurious agent and the injured tissues. The classical signs of acute inflammation are pain, heat, redness, swelling, and loss of function.

Inflammatory breast cancer – is very rare and materializes in the lymph vessels in the skin of the breast. It resembles an infection; the skin becomes thick, raised, and red. Instead of a single lump, it usually involved the entire breast. It is a very fast-growing disease and usually more prone to metastasis.

Infusion – the introduction of a substance, including drugs, into a vein.

Ingestion – the taking of food, drugs, etc., into the body by mouth.

Inguinal orchiectomy – an operation in which the testicle is removed through an incision in the groin.

Inherited gene mutation – is one that is transmitted through genes that have been passed from parents to their offspring.

Inlyta® (Axitinib) – also inhibits several tyrosine kinases, including some that are involved in the formation of new blood vessels. It is taken as a pill twice a day.

Insertion – the part of a muscle that is attached to the part to be moved.

Insulin – a hormone made by the islet cells of the pancreas. It is the major fuel-regulating hormone that is secreted into the blood in response to a rise in concentration of blood glucose or amino acids. Insulin promotes the storage of glucose and the uptake of amino acids, increases protein and lipid synthesis, and inhibits lipolysis and gluconeogenesis.

Intensity – the level of demand that a given activity requires.

Intensity-modulated radiation therapy – is a type of 3-D radiation therapy that targets tumors with greater precision than conventional radiation therapy. Using highly sophisticated computer software and 3-D images from CT scans, the radiation oncologist can develop an individualized treatment plan that delivers high doses of radiation to cancerous tissue while sparing surrounding organs and reducing the risk of injury to healthy tissues.

Intercalary allograft reconstruction – a reconstructive procedure to replace a limb, in which transplants of bone, tendon, ligaments, and connective tissue are used. Often a cast or brace must be worn for six to twelve months until the allograft is healed to the host bone.

Internally rotated – the opposite of externally rotated. Pointing inward/toward the midline of the body.

Interstitial chemotherapy – after a craniotomy is done to remove as much of the tumor as possible, dissolvable wafers containing chemotherapy drugs are implanted directly on or next to the part of the tumor that could not be removed by surgery. Over the course of several weeks, it slowly delivers one thousand times the normal dose of anti-cancer drugs to the affected area of the brain.

Interstitial fluid – fluid found in the spaces around cells. It comes from substances that leak out of blood capillaries and helps bring oxygen and nutrients to cells well as remove waste products from them. As new interstitial fluid is produces, it replaces the older fluid. It then drains towards the lymph vessels and becomes lymph.

Interstitial Pneumonitis – often categorized as both an interstitial lung disease and a form of acute respiratory distress syndrome (ARDS) but it is distinguished from the chronic forms of interstitial pneumonia such as idiopathic pulmonary fibrosis.

Intervention – any measure whose purpose is to improve health or alter the course of disease.

Intestine – also called the bowels and divided into large and small intestine, they extend from the stomach to the anus, where waste products exit the body.

Intraepithelial – within the layer of cells that form the surface or lining of an organ.

Intraoperative radiation – is external beam radiation given during an operation.

Intrathecal chemotherapy – treatment in which anticancer drugs are injected into the cerebrospinal, bypassing the blood-brain barrier, where traditional chemotherapy can't reach.

Intravenous (IV) – within or administered into a vein. It usually refers to a way of giving a drug or fluids through a needle or tube inserted into a vein.

Intravesical therapy – one or more drugs (immunotherapy or chemotherapy may be used) are instilled directly into the bladder through a catheter tube rather than being given by mouth or into a vein. The tube is clamped for a period of time so that the drug remains in contact with the bladder lining.

Invasive (infiltrating) cancer – cancer that has spread beyond its' point of origin and is growing into surrounding, healthy tissues.

Iris – the pigmented cells surrounding the pupil.

Irradiation (radiation therapy) – the use of high-energy radiation to kill cancer cells and shrink tumors. It may come from a machine outside the body, or it may come from radioactive material placed in the body near cancer cells.

Ischemia – is a restriction in blood supply to tissues, causing a shortage of oxygen and glucose needed to keep tissue alive. Ischemia is generally caused by problems with blood vessels, with resultant damage to or dysfunction of tissue.

Islet cell (islet of Langerhans cell) – a pancreatic cell that produces insulin and glucagon which are secreted into the bloodstream. These hormones help control blood sugar levels.

Islet cell carcinoma – a rare cancer that forms in the islet cells in the pancreas.

Isolated limb perfusion - procedure that sends chemotherapy directly to an arm or leg in which the cancer has formed. Blood flow is restricted and anticancer drugs are injected directly into the blood of the limb, sending a higher dose of drugs to the tumor.

Isolation – state of being isolated or separated from others. Isolation is sometimes used to stop the spread of disease.

Isometric – when a muscle exerts force equal to the amount being placed on it.

Isthmus – a narrow part inside the body that connects two larger structures.

Isthmusectomy – surgical removal of the isthmus, the part that connects the two wing-shaped lobes.

Jaundice – yellowish pigmentation of the skin and whites of the eyes. Jaundice is often seen in liver disease such as hepatitis or liver cancer. It may also indicate an obstruction of the biliary tract, for example by gallstones or pancreatic cancer.

Jejunostomy – the creation of a permanent opening between the jejunum and the surface of the abdominal wall. It allows a feeding tube to be put into the small intestine.

Jevtana® (Cabazitaxel) – a recently approved chemotherapy drug for the treatment of metastatic prostate cancers that have progressed in clients taking docetaxzel. Cabazitaxel inhibits the growth of cancer cells.

Joint – the place where two or more bones are connected.

Kaposi's sarcoma (KS) – is cancer that is found in the tissues under the skin or mucous membranes. It causes red-brown or purple patches on the skin, most often on the legs. It spreads to other organs in the body such as the lungs, liver, or intestinal tract. In the 1980's many cases were discovered in people with AIDS. In these cases, lesions may be found in the mouth, nose, lymph nodes, GI tract, lungs, liver, and spleen. KS usually spreads more quickly in clients with AIDS. It may produce significant deterioration in the affected organ. About 30% of AIDS clients develop KS.

KERATITIS - is an inflammation of the cornea (the clear, dome-shaped tissue on the front of the eye) that covers the pupil and iris.

Ketones – build up when the body needs to break down fats and fatty acids to use as fuel. This is most likely to occur when the body does not get enough sugar or carbohydrates. Ketones are also made by the body when there is not enough insulin.

Kidney – one of a pair of organs in the abdomen. The kidneys are essential in the urinary system and also serve homeostatic functions such as the regulation of electrolytes, maintenance of acid–base balance, and regulation of blood pressure. They serve the body as a natural filter of the blood, and remove wastes which are diverted to the urinary bladder. In producing urine, the kidneys excrete wastes such as urea and ammonium, and they are also responsible for the reabsorption of water, glucose, and amino acids.

Kidney cancer – cancer that forms in tissues of the kidneys.

Kidney (renal) failure – a medical condition in which the kidneys fail to adequately remove waste and toxins from the blood or keep body chemicals in balance. Acute kidney failure usually occurs when the blood supply to the kidneys is suddenly interrupted or when the kidneys become overloaded with toxins. Causes of acute failure include accidents, injuries, or complications from surgeries in which the kidneys are deprived of normal blood flow for extended periods of time. Heart-bypass surgery is an example of one such procedure. Chronic kidney failure has numerous causes. The most common is diabetes mellitus. The second most common is long-standing, uncontrolled hypertension, or high blood pressure. Polycystic kidney disease is another well-known cause of chronic kidney disease. Most people afflicted with polycystic kidney disease have a family history of the disease. Overuse of common drugs such as aspirin, ibuprofen, and acetaminophen can also cause chronic kidney damage. A person in end-stage-renal-disease (ESRD) needs or a kidney transplant.

Kinetic chain – the interrelation of the nervous, muscular, and skeletal systems.

KRAS – a genetic mutation that is regularly tested for, and is found to be mutated, in about 25% of clients with non-small cell lung cancer.

Kyphoplasty - is a procedure to inject special cement into a damaged vertebra to stop pain caused by a spinal fracture and stabilize the bone.

Kyphosis – exaggerated outward curvature of the thoracic region of the spine.

Lacriminal duct – tear duct

Lactic acid – is mainly produced in muscle cells and red blood cells. It forms when the body breaks down carbohydrates to use for energy during times of low oxygen levels. Your body's oxygen level might drop during intense exercise or if you have an infection or disease.

Lateral – the opposite of medial. Referring to a position that is relatively further away from the midline of the body; toward the outside of the body.

Lateral flexion – the bending of any aspect of the spine from side to side.

Laparoscopic (minimally invasive) surgery – is a modern surgical technique in which operations in the abdomen are performed through small incisions as opposed to the larger, open surgery incisions. Laparoscopic surgery includes operations within the abdominal or pelvic cavities. There are several advantages to the patient with laparoscopic surgery versus an open procedure. These include reduced pain and shorter recovery time.

Laparotomy – a surgical incision made in the wall of the abdomen.

Large intestine – is the portion of the digestive system most responsible for the absorption of water from the indigestible residue of food. The small intestine passes material into the large intestine at the cecum. Material passes through the ascending, transverse, descending and sigmoid portions of the colon, and finally into the rectum. From the rectum, the waste is expelled from the body.

Laryngeal cancer – cancer that forms in tissues of the larynx.

Laryngectomee – a person whose larynx (voice box) has been removed.

Laryngectomy – an operation to remove all or part of the larynx (voice box).

Laryngitis – inflammation of the larynx.

Laryngoscope – a tubular endoscope that is inserted into the larynx through the mouth and used for observing the interior of the larynx.

Laryngoscopy – is a medical procedure that is used to obtain a view of the vocal folds and the glottis.

Larynx – the part of the respiratory tract between the pharynx and the trachea, having walls of cartilage and muscle and containing the vocal cords enveloped in folds of mucous membrane.

Laser – a device that is used to help diagnose and treat disease by making virtually bloodless cuts with narrow beams of intense light that may be used to cut or destroy tissue.

Layer syndrome – is the combination of LCS and UCS where clients display impairment with motor skills and have a poorer prognosis because of the longer duration of their impairment. You are more likely to see this in the elderly.

LEEP (loop electrosurgical procedure) – a technique that uses a thin, low-voltage electrified wire loop to cut out abnormal tissue.

Left main coronary artery stenosis – the left main coronary artery (an artery that arises from the aorta above the left cusp of the aortic valve and feeds blood to the left side of the heart) becomes tapered and backed up with fat or cholesterol.

Left ventricular non-compaction – occurs when the lower left chamber of the heart, which helps the heart pump blood, does not develop correctly. Instead of the muscle being smooth and firm, the cardiac muscle in the left ventricle is thick and appears spongy. The abnormal cardiac muscle is weak and has an impaired ability to pump blood because it either cannot completely contract or it cannot completely relax.

Leiomyosarcoma – develops in the smooth muscles of the uterus and back part of abdominal cavity. It is very rare.

Leptomeningeal metastasis – when cancer spreads to the tissues that cover the brain and spinal cord.

Lesion – an abnormality in the tissue that is usually caused by disease or trauma.

Lethargy – the quality or state of being drowsy and dull, listless, unenergetic, or listless and lazy. It can be caused by many things, including illness, injury, or drugs.

Leukapheresis - is a procedure in which white blood cells are separated from a sample of blood. It is a specific type of apheresis - the more general term for separating out one particular constituent of blood and returning the remainder to the circulation.

Leukemia – progressive malignant disease that starts in blood-forming tissue such as the bone marrow and causing proliferation of blood cells that enter the bloodstream.

Leukocyte (white blood cell) – a type of immune cell made in the bone marrow and found in the blood and lymphatic tissue. Leukocytes help the body fight infections and other diseases.

Leukoencephalopathy - is all the brain white matter diseases, whether their molecular cause is known or not.

Leukopenia – a condition in which there is a lower-than-normal number of white blood cells in the blood.

Leukoplakia – white patches in the mouth that won't rub off.

Leydig cell tumors – these are usually benign tumors that develop from the Leydig cells in the testicle. Leydig cell tumors develop in adults about 75% of the time and in children about 25%. They often produce androgens but sometimes produce estrogens. Most Leydig cell tumors are contained within the testicle and are cured with surgery.

Libido – sexual desire.

Ligament – the primary connective tissue that connects bone-to-bone to provide stability and limit joint range of motion.

Limb-sparing surgery – administering high-dose radiation as the first step of treatment may shrink an otherwise inoperable soft-tissue sarcoma to a resectable size. The tumor is removed along with a margin of healthy tissue. The removed segment is replaced with a bone graft or metal prosthetic bone. The margin of tissue that has been removed is then replaced with healthy tissue taken from another part of the body. Additional irradiation is given postoperatively.

Lipolysis – the splitting up or decomposition of body fat.

Liposarcoma (includes dedifferentiated, myxoid, and pleomorphic liposarcomas) – are malignant tumors of fat tissue. They can develop anywhere in the body, but they most often develop in the thigh, behind the knee, and inside the back of the abdomen. They occur mostly in adults between 50 and 65 years old.

Liver – a large dark-red gland located in the upper abdomen on the right side, just beneath the diaphragm. The liver stores and filters blood, secretes bile, and converts sugars into glycogen.

Liver cancer – primary liver cancer is cancer that forms in the tissues of the liver. Secondary liver cancer is cancer that metastasizes to the liver from another part of the body.

Load – the amount of weight recommended for an exercise set.

Lobe – a portion of an organ, such as the liver, lung, breast, thyroid, or brain.

Lobectomy – surgery to remove a whole lobe or section of an organ. A bilobectomy is the removal of two of the lobes.

Lobular carcinoma – cancer that begins in the lobules of the breast. Lobular carcinoma in situ (LCIS) isn't really cancer but suggests a high probability of getting it and probably in both breasts. When cancer has spread from the lobules to surrounding tissues, it is invasive lobular carcinoma.

Lobule – a small lobe or a subdivision of a lobe.

Local anesthesia – the injection or application of anesthetic drugs to induce a temporary loss of feeling in one small area of the body. The patient remains awake but has no feeling in the area of the body treated with the anesthetic for an hour or so.

Local cancer – an invasive cancer contained in the organ where the cancer began.

Local therapy – treatment that affects the cancerous cells in the tumor and the area surrounding it.

Local transanal resection (transanal excision) – is done with instruments inserted through the anus, without making an opening in the skin of the abdomen. This operation cuts through all layers of the rectum to remove cancer as well as some surrounding normal rectal tissue, and then closes the hole in the rectal wall. This procedure can be used to remove some T1 N0 M0 stage I rectal cancers that are relatively small and not too far from the anus.

Localization – the process of restricting the site of a lesion or disease to a limited area.

Lordosis – "arching" of the low back.

Low anterior resection – some stage I rectal cancers and most stage II or III cancers in the upper third of the rectum (close to where it connects with the colon) can be removed by low anterior resection. The part of the rectum containing the tumor is removed without affecting the anus. The colon is then attached to the remaining part of the rectum so that after the surgery bowels may be moved in the usual way. The surgeon makes an incision in the abdomen. Then the surgeon removes the cancer and a margin of normal tissue on either side of the cancer, along with nearby lymph nodes and fatty and fibrous tissue around the rectum. The colon is then reattached to the rectum that is remaining so that a permanent colostomy is not necessary.

Lower-crossed syndrome – manifests when the tightness in the thoracolumbar extensors on the dorsal side crosses with the tightness of the iliopsoas and rectus femoris
.
Lower extremity – the lower half of the body that includes the pelvic area, legs, ankles, and feet.

Lumbar spine – the portion of the spine (small of the back) that is located between the chest (thorax) and pelvis.

Lumbar puncture (spinal tap) – a procedure in which a thin needle is put into the lower part of the spinal column to collect cerebrospinal fluid or to give drugs.

Lumbo-pelvic-hip complex – the anatomical structures of the lumbar, thoracic, and cervical spine as well as the pelvic girdle and hip joint.

Lumpectomy – the cancerous breast tissue, with a rim of normal tissue around it, is removed. Whether or not a woman can undergo a lumpectomy is determined by the size of her tumor, the size of her breast, the number of sites of cancer within the breast, and whether the patient can undergo subsequent radiation treatments, among other factors. Clients who choose lumpectomy will likely be advised to have radiation therapy to the breast area after surgery.

Lung – one of a pair of saclike organs of respiration in the chest. They supply the body with oxygen and remove carbon dioxide from the body. It is common for the right lung, which is divided into three lobes, to be slightly larger than the left, which has two lobes.

Lung biopsy – the removal of a small piece of lung tissue to be checked for cancer by a pathologist. The tissue may be removed using a bronchoscope, by fine needle aspiration, by video-guided surgery, or by open surgery. In open surgery, an incision is made between the ribs and a sample of lung tissue is removed for biopsy.

Lung cancer – cancer that forms in tissues of the lung. There are two main types; small cell lung cancer and non-small cell lung cancer. They are diagnosed based on the cells' appearance under a microscope.

Luteinizing hormone – is a hormone produced by gonadotroph cells in the anterior pituitary gland. In females, it triggers the release of eggs (ovulation) and the development of the corpus luteum. In males, it stimulates the production of testosterone.

Luteinizing hormone-releasing hormone – a hormone that acts on the pituitary to stimulate the production of luteinizing hormone; which then stimulates the production of sex hormones in men and women.

Lymph – is the fluid that circulates throughout the lymphatic system. It is formed when the interstitial fluid (the fluid which lies in the interstices of all body tissues) is collected through lymph capillaries. As the blood and the surrounding cells add and remove substances from the interstitial fluid, its composition changes constantly and it eventually changes into lymph fluid. It is then transported through lymph vessels to lymph nodes before emptying ultimately into the right or the left subclavian vein, where it mixes back with blood.

Lymphangiosarcoma – usually develops in the lymph vessels of the arms.

Lymph node (gland) – an oval-shaped organ of the immune system that is surrounded by a capsule of connective tissue. Lymph nodes act as filters or traps for foreign particles and are important in the proper functioning of the immune system. Lymph nodes also have clinical significance. They become inflamed or enlarged in various conditions, which may range from trivial, such as a throat infection, to life-threatening such as cancers. In the latter, the condition of lymph nodes is so significant that it is used for cancer staging, which decides the treatment to be employed, and for determining the prognosis.

Lymph node dissection (lymphadenectomy) – a surgical procedure in which the lymph nodes are removed and a sample of tissue is checked under a microscope for signs of cancer. In a sentinel node biopsy, a single lymph node is removed. In a regional lymph node dissection, some of the lymph nodes in the tumor area are removed. In a radical node dissection, most or all the lymph nodes in the tumor area are removed. Removing one or many lymph nodes puts the patient at risk for lymphedema in that area of the body. The risk increases as a greater number of lymph nodes are removed and/or if radiation is part of their treatment.

Lymph node drainage – the flow of lymphatic fluid from an area of tissue into a specific lymph node.

Lymph node mapping (sentinel lymph node mapping) – is a procedure that uses dyes and radioactive substances to identify the first node or nodes that receive lymphatic fluid from a cancerous tumor.

Lymph vessel – are thin walled, valved structures, that carry lymphatic fluid and white blood cells through the lymphatic system.

Lymphatic elephantiasis – stage three lymphedema. At this stage it is irreversible. The limb is usually hard and fibrotic. It almost always occurs in the legs, or in long-term, untreated lymphedema.

Lymphatic system – is a network of organs, lymph nodes, lymph ducts, and lymph vessels that produce and transport lymph from tissues to the bloodstream. The lymph system is a major component of the body's immune system. It includes the bone marrow, spleen, thymus, lymph nodes, and lymphatic vessels.

Lymphedema – a painful and disfiguring condition that can be caused by the removal of, or damage to the lymphatic system, in which extra lymph fluid builds up in tissues and causes potentially irreversible swelling.

Lymphoblast – an immature cell which typically will differentiate to form a mature lymphocyte. Normally lymphoblasts are found in the bone marrow, but in acute lymphoblastic leukemia (ALL), lymphoblasts proliferate uncontrollably and are found in large numbers in the peripheral blood.

Lymphoblastic – referring to lymphoblasts.

Lymphoblastic lymphoma – is a rare and very fast-growing type of non-Hodgkin lymphoma, a result of abnormal adaptive immune cells, typically T-cells, which are found in the lymph nodes and thymus gland.

Lymphocyte – a type of white blood cell (they make up 20-40% of all white blood cells) that is made in the bone marrow and is found in the blood and in lymph tissue. Lymphocytes can be divided into large lymphocytes and small lymphocytes. Large granular lymphocytes include natural killer cells (NK cells). Small lymphocytes consist of B lymphocytes and T lymphocytes. B lymphocytes make antibodies, and T lymphocytes help kill tumor cells and help control immune responses.

Lymphoma – is a cancer of the lymphocytes, cells that form part of the immune system. There are two types of lymphoma: Hodgkin lymphoma (HL, also called Hodgkin's disease) and non-Hodgkin lymphoma (NHL). Both HL and NHL can occur in the same places and have similar symptoms. There are five subtypes of HL. NHL may derive from either abnormal B or T cells and has 30 subtypes that are distinguished by unique genetic markers. While lymphomas are often confined to lymph nodes and other lymphatic tissue, they can spread to other types of tissue almost anywhere in the body. Lymphoma development outside of lymphatic tissue is called extra-nodal disease.

Lymphoma vaccines – vaccines that are designed to help treat, not prevent, lymphomas. The goal is to create an immune reaction against lymphoma cells in patients who have very early disease or in patients whose disease is in remission. So far they seem to have very limited side effects, but are only available in clinical trials.

Lymphovascular or perineural invasion – sometimes tumor cells can invade the blood vessels, or the lymph or nerve channels within breast tissue.

Lytic lesion – destruction of an area of bone due to a disease such as cancer. Lytic lesions appear as gaping black holes in x-rays and are common in multiple myeloma.

MTCP-1 – is a tumor suppressor gene that may be involved in leukemogenesis.

Macrophages - can locate and 'eat' particles, such as bacteria, viruses, fungi, and parasites. Macrophages are born from white blood cells called monocytes, which are produced by stem cells in our bone marrow.

Maculopathy - is any pathological condition of the macula, an area at the center of the retina that is associated with highly sensitive, accurate vision.

Male breast cancer – cancer that forms in tissues of the breast in men. It is very rare and usually affects older men. Because men typically do not perform self-examinations, by the time the cancer is found, it may be at a more advanced stage.

Malignancy (cancer) – a term for cancerous cells that have the ability to spread to other parts of the body through the blood and lymphatic systems.

Malignant – cancerous.

Malignant giant cell tumor – begins in connective tissue of bone marrow. It may weaken the knees or vertebra and cause bone fractures. Malignant giant cell tumors typically affect ages 40-55. Malignant mesenchymoma – is a rare type of sarcoma that shows features of fibrosarcoma and features of at least 2 other types of sarcoma.

Malignant peripheral nerve sheath tumors (includes neurofibrosarcomas, neurogenic sarcomas, and malignant schwannomas) – include neurofibrosarcomas, malignant schwannomas, and neurogenic sarcomas. These are sarcomas that develop from the cells that surround a nerve.
Malocclusion - imperfect positioning of the teeth when the jaws are closed.

Malnutrition – a condition that occurs when your body is not getting enough key nutrients, such as vitamins and minerals that are needed for optimum health. Malnutrition may occur when there is a lack of nutrients in the diet or when the body cannot absorb nutrients from food. Cancer and cancer treatment may cause malnutrition. If untreated, malnutrition can lead to mental or physical disability, illness, and possibly death

Mammary gland – milk-producing glandular organs in females that are in the chest.

Mammogram – a low energy x-ray of the breast used as a screening and diagnostic tool for abnormalities of the breast.

Mammography – the process of performing a mammogram.

Mandibulectomy – removes all or part of the jaw bone (mandible). Mantle field – mantle-shaped radiotherapy field that covers the neck, mid-chest, and lymph nodes in the armpit.

Margin – the edge or border of the tissue removed in cancer surgery. When no cancer cells are found at the edge of the tissue, it is called a "clean," or "clear" margin; and suggests that all the cancer has been removed.

Marginal mandibulectomy – a piece of jaw bone is removed, but the bone is not cut all the way through.

Mast cells - are very similar to basophil granulocytes (a class of white blood cells) in blood. Both are granulated cells that contain histamine and heparin, an anticoagulant. Basophils leave the bone marrow already mature, whereas the mast cell circulates in an immature form, only maturing once in a tissue site.

Mastectomy – surgery to remove part, or all, of the breast. There are several different types of mastectomy procedures that differ in the amount of tissue and lymph nodes removed, as well as potentially debilitating side-effects.

Mastitis – an infection in the tissue of the breast. It is most often seen in nursing mothers.

Medial – the opposite of lateral. Refers to a position closer to the midline of the body.

Median (Sagittal) Plane – this plane bisects the body into the right and left sides. Joint motion in this plane occurs around a frontal axis and includes flexion and extension.

Mediastinoscopy – two or three incisions are made in the chest and an endoscope is placed inside to assess the lymph nodes and to take biopsies if necessary.

Medical castration – the use of drugs to suppress the function of the ovaries or testicles.

Meditation – is a practice in which an individual trains the mind and/or induces a mode of consciousness to realize some benefit and to minimize distracting or stressful thoughts or feelings. The term "meditation" can refer to the state itself, as well as to practices or techniques employed to cultivate the state. Meditation may help relax the body and mind and improve overall health and well-being. It may be used to help with symptoms related to the diagnosis and treatment of disease in order to help relieve stress, pain, anxiety, and depression.

Medullary breast carcinoma – a rare subtype of invasive ductal carcinoma, accounting for only 5% of all breast cancers. Medullary breast carcinoma can occur at any age, but it usually affects women in their late 40s and early 50s. Medullary carcinoma is more common in women who have a BRCA1 mutation. Medullary breast carcinoma doesn't grow quickly and usually doesn't spread outside the breast to the lymph nodes. For this reason, it's typically easier to treat than other types of breast cancer.

Medullary thyroid cancer – cancer that develops in the C cells of the thyroid and makes up 3-4% of all thyroid cancers. Tumors usually present as a mass in the neck. The C cells make a hormone (calcitonin) that helps maintain a healthy level of calcium in the blood. Approximately 25% of cases are hereditary. Family members can be screened for calcitonin elevation and/or for the RET proto-oncogene.

Medulloblastomas - develop from neuroectodermal cells (early forms of nerve cells) in the cerebellum. They are fast-growing (grade IV) tumors and often spread throughout the CSF pathways, but they can be treated by surgery, radiation therapy, and chemotherapy. Medulloblastomas occur much more often in children than in adults. They are part of a class of tumors called EMBRYONAL TUMORS that can also start in other parts of the central nervous system.

Melanocyte – melanin-producing cells located in the bottom layer of the skin's epidermis, the middle layer of the eye, the inner ear, meninges, bones, and heart.

Melanoma – the most dangerous form of skin cancer that begins in melanocytes. It is the leading cause of death for skin disease. It may begin in a mole, but can also begin in other pigmented tissues, such as in the eye or in the intestines. Often the first sign of melanoma is a change in the size, shape, color or feel of a mole.

Meningiomas – comprise about one in five brain tumors. They materialize in the meningeal membrane that covers the brain and spinal cord. Ninety-five percent of these tumors are benign. Once they are removed, they rarely recur.

Menstruation – the monthly shedding of the uterine lining (endometrium). Most menstrual cycles last from 3-5 days, begin at puberty, and last until menopause (usually 50). Menstruation occurs about every 28 days when a woman is not pregnant, however, cycles can range anywhere from 21 to 35 days in adults and from 21 to 45 days in young teens.

Metabolic – relating to metabolism (the physical and chemical changes that occur in cells to allow growth and maintain body functions).

Metabolite – any substance produced by metabolism.

Metastasis – the transmission of cancer cells from one part of the body to another by way of blood vessels or the lymphatic system.

Metastasize – to spread from one part of the body to another.

Metastatic – having to do with metastasis.

Mixed gliomas – these brain tumors contain two or more types of glial cells. The oligo cell is more promising as far as a better outcome goes because it is highly sensitive to chemotherapy. The most malignant element will determine the course of therapy.

Modality – a method of application of a therapeutic agent or regimen.

Modified radical mastectomy – is the surgical removal of the breast, the nipple, many of the axillary lymph nodes, and the lining over the chest muscle. This procedure has replaced the radical mastectomy as the most common surgery for breast cancer. The nipple and areola may be reconstructed later. The new nipple won't have any sensation, and there will most likely be significant numbness in the remaining skin of the breast.

Mohs micrographic surgery – a surgical procedure in which individual layers of tissue are removed and examined one at a time under a microscope to look for signs of cancer. This is done until all cancer tissue has been removed.

Monoclonal antibody – protein substances which is produced in the laboratory that can bind to substances in the body, including tumor cells. They are made by identical immune cells that are all clones of a unique parent cell and bind only to cancer cell-specific antigens that induce an immunological response against the target cancer cell.

Monoclonal gammopathy of unknown significance (MGUS) - is characterized by the presence of an abnormal protein in the blood that is produced by plasma cells. MGUS can be referred to as a benign condition as there is only a small risk that MGUS can develop into myeloma or a related blood disorder.

Moyamoya disease - is a rare, progressive blood vessel (vascular) disorder in which the carotid artery in the skull becomes blocked or narrowed, reducing blood flow to your brain.

Mucositis – is a condition in which the cells that line the mouth and intestinal tract are destroyed by the high-dose chemotherapy with or without radiation therapy. Symptoms include mouth pain and ulcers, abdominal pain, diarrhea, and infection.

Multiple exostoses - (sometimes called multiple osteochondromas) syndrome is an inherited condition that causes many bumps on a person's bones. These bumps are made mostly of cartilage. They can be painful and deform and/or fracture bones. This disorder is caused by a mutation in any one of the 3 genes EXT1, EXT2, or EXT3. Patients with this condition have an increased risk of chondrosarcoma. An enchondroma is a benign cartilage tumor that grows into the bone. People who get many of these tumors have a condition called multiple enchondromatosis. They have an increased risk of developing chondrosarcomas.

Multiple myeloma – cancer of the plasma cells (white blood cells that produce antibodies).

Muscle balance – the establishment of normal length-tension relationships that help to ensure proper length and strength of each muscle around a joint.

Muscle imbalance – the opposite of muscle balance. The alteration of muscle length surrounding a joint.

Muscle wasting – the wasting or loss of muscle tissue caused by disease or lack of use.

Musculoskeletal – having to do with muscles, nerves, tendons, ligaments, bones, joints, and cartilage.

Myeloablative chemotherapy - high-dose chemotherapy that kills cells in the bone marrow, including cancer cells. It lowers the number of normal blood-forming cells in the bone marrow and can cause severe side effects. Myeloablative chemotherapy is usually followed by a bone marrow or stem cell transplant to rebuild the bone marrow.

Myelodysplastic syndrome - a group of diverse bone marrow disorders in which the bone marrow does not produce enough healthy blood cells. MDS is often referred to as a "bone marrow failure disorder".

Myeloproliferative neoplasms - are blood cancers that occur when the body makes too many white or red blood cells, or platelets. This overproduction of blood cells in the bone marrow can create problems for blood flow and lead to various symptoms.

Myocarditis – inflammation of the heart muscle.
Myxofibrosarcoma, low-grade – are most often found in the arms and legs of elderly patients. They are most common in or just under the skin and there might be more than one tumor nodule.

Narcotic – a drug (such as opium or morphine) that in moderate doses dulls the senses, relieves pain, and induces profound sleep but in excessive doses causes stupor, coma, or convulsions.

Nasal – having to do with the nose.

Nasopharyngeal cancer – is the most common cancer originating in the nasopharynx, the uppermost region of the pharynx (throat), behind the nose where the nasal passages and auditory tubes join the remainder of the upper respiratory tract.

Nasopharynx – the uppermost region of the pharynx (throat), behind the nose where the nasal passages and auditory tubes join the remainder of the upper respiratory tract.

Natural killer (NK) cells - are a type of lymphocyte that control several types of tumors and microbial infections by limiting their spread and subsequent tissue damage.

Near-total thyroidectomy – surgery to remove the lobe containing the tumor, the isthmus, and most of the opposite lobe. This procedure is also known as a subtotal thyroidectomy.

Neck dissection (cervical neck dissection) – surgery to remove lymph nodes and other tissues in the neck.

Necrosis – tissue death.

Neoplasm – an abnormal mass of tissue that results when cells divide more than they should or do not die when they should. Neoplasms may be benign (not cancer), or malignant (cancer). Also called tumor.

Nephrectomy – surgery to remove all or part of a kidney. In a partial nephrectomy, part of a kidney is removed. In a simple nephrectomy, an entire kidney is removed. In a radical nephrectomy, an entire kidney, the adrenal gland and nearby lymph nodes, and other surrounding tissue is removed. In a bilateral nephrectomy, both kidneys are removed.

Nerve – an enclosed cable-like bundle of axons in the peripheral nervous system. They convey impulses of sensation, motion, etc., between the brain or spinal cord and other parts of the body. The messages are sent by chemical and electrical changes in the cells that make up the nerves.

Nerve block – injection of an anesthetic into or around a nerve, or into the spine, to block pain.

Nerve-sparing radical prostatectomy – a modified form of a radical retropubic prostatectomy in an effort to preserve sexual potency and urinary continence.

Nerve-sparing surgery – type of surgery that attempts to save the nerves near the tissues being removed.

Nervous system – the organ system which, along with the endocrine system, correlates the adjustments and reactions of a person to their internal and external environment, comprising the central and peripheral nervous systems.

Neuroendoscopy – a neurosurgeon works through a small opening in the skull using a thin tube with a powerful lens and high-resolution video camera to see into the skull and brain. Advantages of this minimally invasive neurosurgical procedure include a small incision site, an enhanced ability to perform microsurgical procedures, and potentially less trauma to healthy tissue. Following surgery, an MRI is performed to determine the extent of tumor removal and to help plan further treatment.

Neurofibromatosis type I - is a genetic disorder that causes tumors to form on nerve tissue. These tumors can develop anywhere in your nervous system, including your brain, spinal cord and nerves. Neurofibromatosis is usually diagnosed in childhood or early adulthood.

Neurofibrosarcoma – develops in the peripheral nerves of the arms, legs, and trunk.

Neuron – the functional unit of the nervous system.

Neurotransmitters – chemical messengers that cross the neuromuscular junction to trigger appropriate receptor sites.

Neuropathy (peripheral neuropathy) – is damage to nerves of the peripheral nervous system, which may be caused either by diseases of or trauma to the nerve or the side effects of systemic illness. Common symptoms associated with damage to the motor nerve are muscle weakness, cramps, and spasms. Loss of balance and coordination may also occur. Damage to the sensory nerve can produce tingling, numbness, and a burning pain.

Neurotoxicity – occurs when the exposure to toxic substances (neurotoxins) cause damage to nervous tissue. Neurotoxicity can result from exposure to substances used in chemotherapy, radiation treatment, drug therapies, certain drug abuse, and organ transplants, as well as exposure to heavy metals, certain foods, pesticides, industrial and/or cleaning solvents, cosmetics, and some naturally occurring substances. Symptoms may appear immediately after exposure or be delayed. They may include limb weakness or numbness, loss of memory, vision, and/or intellect, uncontrollable obsessive and/or compulsive behaviors, delusions, headache, cognitive and behavioral problems and sexual dysfunction. Individuals with certain disorders may be especially vulnerable to neurotoxins.

Neurotoxin – a substance that is toxic to nerve tissue.

Neurotransmitters – are the chemicals which allow the transmission of signals from one neuron to the next across synapses. They are also found at the axon endings of motor neurons, where they stimulate the muscle fibers.

Neutropenia – is an abnormally low count of neutrophils, white blood cells that help your immune system fight off infections, particularly of bacteria and fungi. You have several types of white blood cells, and between 45 and 70 percent of all white blood cells are neutrophils.

Neutrophils - are a type of white blood cell (WBC or granulocyte) that protect us from infections, among other functions. They make up approximately 40 percent to 60 percent of the white blood cells in our bodies and are the first cells to arrive on the scene when we experience a bacterial infection.

Nexavar® (Sorafenib) – has been shown to slow the progression of the cancer in some clients with advanced kidney disease. It acts by blocking both angiogenesis and growth stimulating molecules in the cancer cell. Sorafenib does this by blocking several important cellular enzymes called tyrosine kinases that are important for cell growth and survival. It is taken as a pill.

Nipple – the small raised projection in the center of the breast through which milk can flow.

Nipple discharge – the release of fluid, other than milk, coming from the nipple.

Nipple-sparing mastectomy – in this procedure the nipple and areola are left in place while the breast tissue under them is removed. Women who have a small early stage cancer near the outer part of the breast, with no signs of cancer in the skin or near the nipple, are better candidates for nipple-sparing surgery. Cancers that are larger or nearby may mean that cancer cells are hidden in the nipple. Some doctors give the nipple tissue a dose of radiation during or after surgery to try and reduce the risk of the cancer coming back.

Nocturia - is a condition in which you wake up during the night because you must urinate. Causes include high fluid intake, sleep disorders, and bladder obstruction. Treatment includes certain activities, such as restricting fluids.

Node-negative – cancer that is contained at its' site of origin and has not spread to the lymph nodes.

Node-positive – cancer that has spread beyond its' site of origin to the lymph nodes.

Nodule – a growth or lump that may be malignant (cancer) or benign (not cancer).

Non-Hodgkin lymphoma (NHL) – a type of cancer of the immune system. NHL involves white blood cells (known as lymphocytes). Under normal conditions, these cells help defend your body from disease. In people with NHL, too many abnormal white blood cells build up in the blood, bone marrow, spleen, and/or lymph nodes. There are more than 30 types of NHL. They are divided into 2 main categories: indolent NHL and aggressive NHL. These correspond to how fast the tumors are growing. Most NHL occurs in white blood cells called B-cells.

Non-seminomas – testicular cancers that usually occur in men between their late teens and early 30s. Most tumors are mixed with at least two different types, but this does not change treatment. All non-seminoma germ cell cancers are treated the same way. There are four main types of non-seminoma tumors.

Non-small cell lung cancer (NSCLC) – is the most common type of lung cancer. It usually grows and spreads more slowly than cancer. There are three common forms of NSCLC: adenocarcinomas are often found in an outer area of the lung, squamous cell carcinomas are usually found in the center of the lung next to an air tube (bronchus), large cell carcinomas can occur in any part of the lung. They tend to grow and spread faster than the other two types.

Non-invasive – cancer that has not spread outside the point of origin.

Non-malignant (benign) – not cancerous.

Non-melanoma skin cancer – there are two main types of nonmelanoma skin cancer: most nonmelanoma cancers are basal cell carcinoma. It can damage deeper tissues, such as muscles and bones, but almost never spreads to other parts of the body. Squamous cell carcinoma is less common. It often starts in skin that has been injured or diseased. It sometimes spreads to other parts of the body.

Non-metastatic – cancer that has not spread from the primary site (point of cancer origin) to other places in the body.

Non-opioid – acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDS) such as aspirin and ibuprofen.

Non-prescription – a medicine that can be bought without a prescription (over-the counter).

Noonan syndrome - is a genetic disorder that prevents normal development in various parts of the body. A person can be affected by Noonan syndrome in a wide variety of ways. These include unusual facial characteristics, short stature, heart defects, other physical problems and possible developmental delays.

Normal range – is a set of values that are used to interpret a patient's test results. It is based on the results that are seen in 95% of the healthy population. Norms may vary with gender, age, sex, and race.

Nutritional counseling – is an ongoing process in which a health professional, usually a registered dietitian, works with an individual to assess his or her usual dietary intake and identify areas where change is needed. The nutrition counselor provides information, educational materials, support, and follow-up to help the individual make and maintain the needed dietary changes.

Nutritionist (dietician) – are experts in food and nutrition. They advise people on what to eat in order to lead a healthy lifestyle or achieve a specific health-related goal.

Obese – is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems.

Observation – watching a patient's condition (watch and wait), but not administering treatment unless symptoms appear or change.

Obstruction – a condition of being clogged or blocked; something that obstructs.

Obstructive lung disease - is a category of respiratory disease characterized by airway obstruction.

Occlusion - the blockage or closing of a blood vessel or hollow organ.

Occlusive Cerebral vasculopathy (central nervous system vasculopathy) - inflammation of the blood vessel wall involving the brain and occasionally the spinal cord.

Ocular melanoma – is the most common primary cancer of the eye in adults.

Oligodendrogliomas – these brain tumors form in oligodendrocytes, another type of glial cell that transmits nerve impulses. These cells grow so slowly that they may not be detected for years.

Omentectomy – surgery to remove part or all the omentum.

Omentum – is a large fatty structure which hangs off the middle of the colon and drapes over the intestines inside the abdomen.

Ommaya reservoir – a device placed under the scalp and used to deliver anticancer drugs to the cerebrospinal fluid.

Oncocytoma – a type of renal cortical kidney cancer that accounts for 5-10% of kidney tumors. They have almost no risk of spreading or causing death.

Oncogene – is a gene that has the potential to cause cancer. In tumor cells, they are often mutated or expressed at high levels. Most normal cells undergo a programmed form of death (apoptosis). Activated oncogenes can cause those cells that ought to die to survive and proliferate instead.

Oncologist – a doctor who specializes in treating cancer.

Oncology – the study of cancer.

Oncology nurse – a nurse whose specialty is taking care of people with cancer.

Oncotype DX breast cancer assay – is a diagnostic test that quantifies the likelihood of disease recurrence in women with early-stage hormone estrogen receptor (ER) positive only breast cancer (prognostic significance) and assesses the likely benefit from certain types of chemotherapy (sparing those who will not benefit from chemotherapy from undergoing unnecessary treatment).

Oophorectomy – surgery to remove one or both ovaries.

Open colectomy – an operation to remove all or part of the colon through a lengthy incision in the abdomen wall. Partial and complete colectomies can also be done laparoscopically.

Open prostatectomy – an operation to remove part, or all of the prostate through a lengthy incision in the lower abdomen (retropubic) or perineum – the area between the anus and scrotum (perineal).

Operable – able to treat by surgical operation.

Opiate – a narcotic drug containing or derived from opium used to treat pain or cause sleep. Examples of opiates are codeine, heroin, and morphine.

Opioid – is a psychoactive chemical that works by binding to opioid receptors, which are found principally in the central and peripheral nervous system and the gastrointestinal tract. The receptors in these organ systems mediate both the beneficial effects and the side effects of opioids.

Optic chiasm neuropathy – damage to the the X-shaped structure formed by the crossing of the optic nerves in the brain.

Oral cancer – cancer of the mouth.

Oral cavity – the part of the mouth behind the teeth and gums that is bounded above by the hard and soft palates and below by the tongue and the mucous membrane connecting it with the inner part of the mandible.

Oral cavity cancer – cancer that forms in the oral cavity.

Orbital hypoplasia - is a congenital disorder characterized by underdevelopment of the optic nerves.

Orchiectomy (castration) – surgery to remove one or both testicles. Origin – the more fixed, central attachment of a muscle.

Oropharyngeal cancer – is a disease which malignant cells form in the tissue of oropharynx. Oropharynx is a middle part of the throat which includes the base of the tongue, the tonsils, the soft palate, and the walls of the pharynx. Oropharyngeal cancers can be divided into two types, HPV-positive, which are related to human papillomavirus infection, and HPV-negative cancers, which are usually linked to alcohol or tobacco use.

Oropharynx – the middle part of the throat which includes the base of the tongue, the tonsils, the soft palate, and the walls of the pharynx.

Orthopnea - is shortness of breath (dyspnea) that occurs when lying flat, causing the person to have to sleep propped up in bed or sitting in a chair.

Osteoarthritis – is the most common joint disorder, which is due to aging and wear and tear on a joint.

Osteoblasts – are mononucleate cells that are responsible for bone formation

Osteoclasts – large multinuclear cells associated with absorption and removal of bone

Osteonecrosis – is a disease resulting from the temporary or permanent loss of blood supply to the bones. Without blood, the bone tissue dies, and ultimately the bone may collapse. It most commonly affects the ends (epiphysis) of the femur, the bone extending from the knee joint to the hip joint. Other common sites include the upper arm bone, knees, shoulders, and ankles. The disease may affect just one bone, more than one bone at the same time, or more than one bone at different times. Osteonecrosis of the jaw (ONJ) is a rare condition that has been linked to the use of biphosphonate medications.

Osteopenia – is a condition where bone mineral density is lower than normal. It is considered by many doctors to be a precursor to osteoporosis.

Osteoporosis – is a disease of bones that leads to an increased risk of fracture. In osteoporosis, the bone mineral density (BMD) is reduced, bone microarchitecture deteriorates, and the amount and variety of proteins in bone are altered.

Osteoradionecrosis - is bone death due to radiation.

Osteosarcoma – is the most common type of bone cancer. It originates in the newly forming tissue of the bone and develops in the long bones of the arms and legs. It contains immature bone cells that destroy and replace normal tissue, weakening the bone. It is usually found in the area of the knee joint, however, it can occur in the arm or back, or less commonly, in any other bone. The main danger is that has a high tendency to spread to distant areas of the body, particularly the lungs. Osteosarcoma typically affects ages 10-25.

Ostomy – refers to the surgically created opening (stoma) in the body for the discharge of body wastes.

Otolaryngology – the practice of surgical management and treatment of patients with diseases and disorders of the ear, nose, throat (ENT), and related structures of the head and neck.

Ototoxicity - refers to drug or chemical-related damage to the inner ear, resulting in damage to the organs responsible for hearing and balance. Such damage can lead to temporary or permanent hearing loss, and/or loss of balance.

Ovarian – having to do with the ovaries (a pair of female reproductive glands in which eggs are formed).

Ovarian ablation (suppression) – has been used for more than a century in the treatment of breast cancer. Methods of irreversible ovarian ablation include surgical oophorectomy and ovarian irradiation.

Ovarian cancer – cancer that forms in the ovaries.

PARP (poly-ADP-ribose polymerase) Inhibitors – a new class of drugs currently being studied for ovarian cancer. PARP enzymes inside a cell typically repair damage to the cell's DNA. The goal is that by stopping PARP activity in cancer cells, they will prevent the cellular repair and cause apoptosis (programmed cell death).

PNF stretching (proprioceptive neuromuscular facilitation) – a shortening contraction of the opposing muscle to place the target muscle on stretch, this is followed by an isometric contraction of the target muscle.

Pain threshold – the point at which pain begins to be felt.

Palate – the roof of the mouth.

Palliative care – is an area of healthcare that focuses on relieving and preventing the suffering of clients, without curing the disease. Pallor - an unhealthy pale appearance.

Pancreas – is a gland located behind the stomach. It releases the hormones, insulin and glucagon, as well as digestive enzymes that help you digest and absorb food.

Pancreatectomy – surgery to remove all or part of the pancreas.

Pancreatic – having to do with the pancreas.

Pancreatic (exocrine) cancer – a disease in which cancer cells are found in the tissues of the pancreas.

Pancreatitis – inflammation of the pancreas.

Pancreatoduodenectomy (whipple procedure) – a type of surgery used to treat pancreatic cancer. This operation is performed to treat cancerous tumors on the head of the pancreas, or those involving the common bile duct, and the duodenum.

Pap smear (test) – is a screening test used to detect potentially pre-cancerous and cancerous cells in the endocervical canal of the female reproductive system.

Papillary, or chromophil kidney cancer – a type of renal cortical kidney cancer that makes up 10-15% of cases. Papillary carcinomas can develop as individual or multiple tumors, appearing either in the same kidney or in both kidneys. There are two types of papillary cancers, Type 1 and Type 2. Type 1 is more common and usually grow slowly. Type 2 is more aggressive. Papillary carcinomas have been associated with genetically inherited syndromes, including hereditary papillary renal cell carcinoma (HPRCC) and hereditary leiomyomatosis and renal cell carcinoma (HLRCC).

Papillary thyroid cancer – accounts for 75% to 85% of all thyroid cancer cases. It occurs more frequently in women and presents in the 30-40 year age group. It is also the predominant cancer type in children with thyroid cancer, and in clients with thyroid cancer who have had previous radiation to the head and neck.

Papillopathy - unilateral or bilateral optic disc swelling in which the patient has either type 1 or type 2 diabetes mellitus.

Paralysis – complete or partial loss of muscle function for one or more muscles.

Parathyroid gland – are small endocrine glands in the neck that produce parathyroid hormone. Parathyroid glands control the amount of calcium in the blood and within the bones.

Paresethia – sensations of tickling, tingling, burning, pricking, or numbness of a person's skin with no apparent long-term physical effect. It is more generally known as the feeling of "pins and needles" or of a limb "falling asleep". The manifestation of paresthesia may be transient or chronic.

Partial (segmental)cystectomy – is a bladder-preserving treatment that involves surgical removal of the bladder tumor and surrounding bladder wall

Partial (subtotal) hysterectomy – surgery to remove the uterus, but not the cervix.

Partial laryngectomy – is the surgical removal of a portion of the larynx, or the voice box.

Partial (segmental) mastectomy – surgical removal of the cancer, a wedge of normal tissue around it, and the lining over the chest muscle below the tumor. Usually some axillary lymph nodes are removed. In almost all cases there will be a course of radiation therapy following the surgery.

Partial nephrectomy – removes only the diseased part of the kidney while sparing the healthy, functioning kidney tissue.

Partial oophorectomy – surgery to remove one or both ovaries.

Partial remission – may be defined as 50% or greater reduction of tumor growth as may be found on physical examination, radiologic study, or by biomarker levels from a blood or urine test.

Partial-thickness mandibular resection (marginal mandibulectomy) – may be all that is needed if the jaw bone looks normal on x-ray, and there is no evidence the cancer has spread into the jaw bone. In this procedure a piece of jaw bone is removed, but the bone is not cut all the way through.

Passive range of motion (ROM) – the opposite of active ROM. The amount of movement obtained by the examiner without the assistance of the client/patient.

Pathology report – is a document that contains the diagnosis determined by examining cells and tissues under a microscope. This plays an important role in cancer diagnosis and screening.

Pelvic exenteration – is the most extensive pelvic surgery. It is used most often when cancer of the cervix has come back in the pelvis after surgery or radiation therapy. In this surgery, the uterus, cervix, ovaries, fallopian tubes, vagina, bladder, urethra, and rectum are removed. Two ostomies are created, one for urine and one for stool. The vagina is usually rebuilt.

Pelvic inflammatory disease (PID) - refers to infection of the uterus, fallopian tubes, and other reproductive organs. It is a serious complication of some sexually transmitted diseases (STDs), especially chlamydia and gonorrhea. PID can damage the fallopian tubes and tissues in and near the uterus and ovaries.

Pelvic lymphadenectomy – surgery to remove lymph nodes in the pelvis to determine if there are cancer cells present.

Pelvic wall – the muscles and ligaments that line the part of the body between the hips.

Pericarditis – inflammation of the membranous sac enclosing the heart.

Perimenopausal – is technically defined as the time from which menses start to become irregular and FSH levels have increased, until the time when it is known that periods have ceased completely.

Perineal colostomy – an opening made surgically to allow the colon to exit the body through the perineum. A new path for waste material to leave the body is provided after part of the colon has been removed.

Perineal prostatectomy – surgery to remove the prostate through an incision made between the scrotum and the anus (perineum).

Perineum – the area of the body between the anus and the vulva in females, and between the anus and the scrotum in males.

Perineural – occurring about or around nervous tissue or nerves.

Periodontal disease - are infections of the structures around the teeth, which include the gums, periodontal ligament and alveolar bone.

Peripheral blood stem cell transplant – is a method of replacing blood-forming stem cells destroyed by cancer treatment. PBSCT is now a much more common procedure than its bone marrow harvest equivalent; this is in-part due to the ease and less invasive nature of the procedure.

Peripheral neuropathy – is a result of nerve damage and often causes numbness and pain in the hands and feet. The pain of peripheral neuropathy is usually described as tingling, numbness, or burning. It can result from problems such as traumatic injuries, chemotherapy, infections, metabolic problems, and exposure to toxins. One of the most common causes is diabetes. In many cases, peripheral neuropathy symptoms improve with time – especially if the condition is caused by an underlying condition that can be treated.

Peritoneal – relating to or affecting the peritoneum (the tissue that lines the abdominal wall and pelvic cavity).

PET scan (positron emission tomography) – is an imaging test that uses a radioactive substance called a tracer to look for disease in the body.

Petechiae - are tiny, circular, non-raised patches that appear on the skin or in a mucous or serous membrane. They occur as the result of bleeding under the skin.

Phantom limb pain – is pain that is felt in the area where a limb has been amputated.

Pharmacokinetics - the study of the movement of drugs in the body, including the processes of absorption, distribution, localization in tissues, biotransformation, and excretion.

Pharynx (throat) – is the part of the throat that is right below the mouth and nasal cavity, and above the esophagus and larynx. The human pharynx is conventionally divided into three sections: the nasopharynx the oropharynx, and the laryngopharynx. The pharynx is part of the digestive system and also the respiratory system; it is also important in vocalization.

Photodynamic therapy – is a treatment that uses special drugs, called photosensitizing agents, along with light to kill cancer cells.

Photosensitizing agent – an agent used in photodynamic therapy which, when absorbed by cells and exposed to light, is activated, killing cancer cells. PDT may also work by destroying the blood vessels that feed the cancer cells and by alerting the immune system to attack the cancer. It can only treat areas where light can reach. This means it is mainly used to treat problems on or just under the skin, or in the lining of internal organs.

Pineal region tumors - occur in or around the pineal gland, a small organ located in the center of the brain. The pineal gland produces melatonin, a hormone that plays an important role in the sleep-wake cycle. They can be slow growing (pineocytoma) or fast growing (pineoblastoma). Since the pineal region is very difficult to reach, it requires a high level of surgical expertise to remove these tumors. Pineoblastoma - is a rare, aggressive type of cancer that begins in the cells of the brain's pineal gland

Pineocytoma - is one of several different types of tumors that arise in the area of the pineal gland, requiring different therapies. The exact diagnosis is critical for choosing the correct therapy. Pineal tumors typically present with hydrocephalus, a buildup of fluid pressure within the brain.

Pitting edema – in stage/ one lymphedema, when the skin is pressed the pressure will leave a pit that takes some time to fill back in.

Pituitary gland – a pea-sized gland located at the base of the skull between the optic nerves. The pituitary gland secretes hormones. The pituitary is sometimes referred to as the “master gland” as it controls hormone functions such as our temperature, thyroid activity, growth during childhood, urine production, testosterone production in males and ovulation and estrogen production in females. In effect the gland functions as our thermostat that controls all other glands that are responsible for hormone secretion.

Pituitary tumors - develop from the pituitary gland and are usually benign. They are divided by size into macroadenomas (greater than 1 cm in size) and microadenomas (less than 1 cm in size). Arising from the pituitary gland, these tumors can over-produce a variety of hormones that cause symptoms such as fatigue, menstrual irregularities, and weight gain or loss, among many others. Most pituitary tumors, however, do not produce hormones. These tumors, which are common among 30-50 year-olds.

Plane of motion – refers to the plane in which exercise is performed.

Plasmapheresis – plasma is removed from blood cells by a cell separator. The separator spins blood at a rapid speed to separate blood cells from the plasma, or it passes the blood through a membrane with pores so tiny that only plasma can fit through. Cells are put back in the body while the plasma is disposed of and replaced with other liquids such as a saline and albumin combination, fresh frozen plasma, or a plasma substitute. In a method like kidney dialysis treatment, this procedure removes autoantibodies, contained in the plasma, from the blood.

Plastic surgery – is a medical specialty concerned with the correction or restoration of form and function.

Platelet (thrombocyte) – a small colorless disk-shaped cell fragment without a nucleus, found in large numbers in blood and involved in clotting.

Pleura - is a serous membrane which folds back onto itself to form a two-layered membranous pleural sac. The outer pleura is attached to the chest wall but is separated from it by the endothoracic fascia. The inner pleura covers the lungs and adjoining structures, including blood vessels, bronchi and nerves.

Pleural cavity – is the potential space between the two pleura (visceral and parietal) of the lungs.

Pleural effusion – is a buildup of fluid between the layers of tissue that line the lungs and chest cavity.

Pneumonectomy – a surgical procedure to remove a lung.

Pneumonia – is a lung infection affecting primarily the microscopic air sacs known as alveoli. It is usually caused by infection with viruses or bacteria and less commonly other microorganisms, certain drugs and other conditions such as autoimmune diseases. Symptoms include cough, fever, chest pain, and difficulty breathing.

Pneumonitis (pulmonitis) – inflammation of the lung tissue.

Pneumothorax – collapse of a lung; a collection of air in th space of the lungs that puts pressure on the lung so that it cannot expand as much as it normally does when a breath is taken.

Polypectomy – removal of polyps in the colon to look for signs of cancer.

Positive axillary lymph node – when cancer has spread to a lymph node in the area of the armpit (axilla).

Posterior – the opposite of anterior. Has to do with a structure found toward the back of the body.

Posterior pelvic tilt – the opposite of an anterior pelvic tilt (lordosis). A movement in which the pelvis rotates backward; typically associated with a flat back.

Postmenopausal – the time of a woman's life following menopause.

Postoperative – after surgery.

Postural deviation – muscle imbalance/poor posture. Misalignment of the kinetic chain that can lead to joint deterioration and injury.

Posture – position of the body for alignment of the kinetic chain.

Potassium – is a very important mineral for the proper function of all cells, tissues, and organs in the human body. It is also an electrolyte, a substance that conducts electricity in the body, along with sodium, chloride, calcium, and magnesium. Potassium is crucial to heart function and plays a key role in skeletal and smooth muscle contraction, making it important for normal digestive and muscular function.

Premature atrial contractions – a type of irregular heartbeat which starts in the upper two chambers of the heart. They are not as serious as premature ventricular contractions. An individual with this condition may report feeling that his or her heart "stops" after a symptom. They are also called heart palpitations.

Premature ventricular contractions – a type of irregular heartbeat which starts in the lower chambers of the heart.

Proctectomy – a surgical procedure to remove the rectum.

Progesterone – is a female hormone important for the regulation of ovulation and menstruation.

Progesterone receptor (PR) – is a protein found in cells, activated by the hormone progesterone that is a useful prognostic indicator of breast cancers that are likely to respond to anti-estrogen receptor (ER) therapies.

Progesterone receptor negative (PR-) – describes cancer cells that do not need progesterone to grow. Therefore, they do not respond when treated with hormones that block progesterone from binding.

Progesterone receptor positive – describes cells that have a protein to which the hormone progesterone will bind. Cancer cells that are progesterone receptor positive need progesterone to grow and will usually stop growing when treated with hormones that block progesterone from binding. Also called PR+.

Progesterone receptor test – a lab test to find out if cancer cells have progesterone receptors (proteins to which the hormone progesterone will bind). If the cells have progesterone receptors, they may need progesterone to grow, and this can affect how the cancer is treated.

Progestin – a natural or synthetic progestational substance that mimics some or all the actions of progesterone.

Prognosis – the likely course of a disease or ailment; the likelihood of recovery or recurrence from a disease.

Programmed cell death (apoptosis) – a genetically directed process of cell self-destruction that is marked by the fragmentation of nuclear DNA, is activated either by the presence of a stimulus or removal of a suppressing agent or stimulus, and is a normal physiological process eliminating DNA-damaged, superfluous, or unwanted cells.

Progression – movement or development of a disease toward a more advanced state.

Proliferating – increasing rapidly in numbers.

Prolymphocytes - is a white blood cell with a certain state of cellular differentiation in lymphocytopoiesis (generation of lymphocytes).

Pronation – the opposite of supination. A rotational movement of the forearm at the radioulnar joint, or of the foot at the subtalar and talocalcaneonavicular joints.

Prone – the opposite of supine. Laying on one's stomach.

Prophylactic – acting to defend against or prevent something, especially disease; protective.

Prophylactic cranial irradiation – radiation therapy to the head to minimize the risk that cancer will spread to the brain.

Prophylactic mastectomy – surgery to reduce the risk of developing breast cancer by removing one or both breasts before disease develops. Recommended for women with LCIS.

Prophylactic oophorectomy – surgery to reduce the risk of ovarian cancer by removing the ovaries before the disease develops.

Proprioception – a form of sensory (afferent) information that uses mechanoreceptors to provide information about static and dynamic positions, movements, and sensations related to muscle force and movement.

Prostate – a gland surrounding the bladder neck and urethra in the male; it contributes a secretion to the semen.

Prostate cancer – cancer that forms in tissues of the prostate; usually occurs in older men.

Prostatectomy – surgery to remove part, or all, of the prostate and some of the surrounding tissue. Nearby lymph nodes may also be removed. It may be done through a retropubic incision made in the wall of the lower abdomen, or an incision in the perineum (the area between the anus and the scrotum).

Prosthesis – an artificial device to replace a missing body part.

Protease inhibitor – are a class of drugs used to treat or prevent infection by viruses, including HIV and Hepatitis C.

Protein – of a group of complex organic macromolecules that contain carbon, hydrogen, oxygen, nitrogen, and usually sulfur and are composed of one or more chains of amino acids.

Protein synthesis – the process in which cells build proteins.

Prothrombin - a protein present in blood plasma which is converted into active thrombin during coagulation.

Proton – a stable subatomic particle occurring in all atomic nuclei, with a positive electric charge equal in magnitude to that of an electron.

Proton beam radiation therapy – a type of radiation therapy that uses streams of protons to kill tumor cells; minimizing damage to the surrounding healthy tissue.

Proto-oncogenes – is a normal gene which, when altered by mutation, becomes an oncogene that can contribute to cancer. Proto-oncogenes may have many different functions in the cell. Some proto-oncogenes provide signals that lead to cell division. Other proto-oncogenes regulate programmed cell death (apoptosis).

Provenge® (Sipuleucel-T) – is made by harvesting a patient's immune cells, engineering them to fight prostate cancer cells, and reinfusing them into the patient. Provenge has been shown to extend survival in men with metastatic prostate cancer.

Proximal – the opposite of distal. Referring to a position closer to the midline of the body than another part.

Proximal colon – the first and middle parts of the colon that includes the cecum (a pouch that connects the small intestine to the colon), the ascending colon, and the transverse colon.

Proximal subtotal gastrectomy – the upper stomach as well as the lower esophagus is removed then the gullet is sewed to the stomach.

PSA (prostate-specific antigen) – is a protein made by the prostate cells, found in the blood, and used to help detect prostate cancer.

Pulmonary – having to do with the lungs.

Pulmonary edema – abnormal buildup of fluid in the air sacs of the lungs. It is often cause by congestive heart failure, but it can be caused by high blood pressure, pneumonia, certain toxins and medicines, or living at a high altitude as well. Symptoms include coughing up blood, shortness of breath, and difficulty exercising.

Pulmonary hypertension – is abnormally high blood pressure in the arteries of the lungs. It makes the right side of the heart work harder than normal.

Pulmonary infarction – (usually hemorrhagic) is most commonly caused by pulmonary embolism (PE) in combination with chronic left heart failure. It occurs in the minority (10-15%) of clients with PE.

Punch biopsy – a technique that involves the use of a circular blade that is rotated down through the epidermis and dermis, and into the subcutaneous fat, yielding a 3- to 4-mm cylindrical core of tissue sample which is then examined under a microscope.

Q-angle – is formed in the frontal plane by two-line segments: from tibial tubercle to the middle of the patella. It has been linked to increased knee pain, ACL injuries and patellofemoral pain syndrome in women.

Quality of life – all aspects of emotional, physical, and social satisfaction with life.

Radiation brachytherapy (internal radiotherapy) – is a procedure that involves placing radioactive material inside the body. It allows doctors to deliver higher doses of radiation to specific areas of the body, compared with external beam radiation that projects radiation from a machine outside of your body. Brachytherapy may cause fewer side effects than does external beam radiation, and the overall treatment time is usually shorter with brachytherapy.

Radiation oncologist – is a physician who specializes in the treatment of cancer clients, using radiation therapy as the main modality of treatment.

Radiation sickness – serious illness caused by exposure to a large dose of ionizing of radiation over a short period of time. The onset and type of symptoms depends on the radiation exposure. Relatively smaller doses result in gastrointestinal effects such as nausea and vomiting and symptoms related to falling blood counts such as infection and bleeding. Relatively larger doses can result in neurological effects and rapid death. Treatment of acute radiation syndrome is generally supportive with blood transfusions and antibiotics.

Radical cystectomy – surgical removal of the entire bladder, nearby lymph nodes (lymphadenectomy), part of the urethra, and nearby organs that may contain cancer cells. In men, the prostate, the seminal vesicles, and part of the vas deferens are also removed. In women, the cervix, the uterus, the ovaries, the fallopian tubes, and part of the vagina are also removed.

Radical hysterectomy – surgical removal of the uterus, cervix, and part of the vagina. The ovaries, fallopian tubes, and nearby lymph nodes are also removed.

Radical excision – takes out the entire area containing cancer with margins extending approximately 5 centimeters on all sides.

Radical inguinal orchiectomy – removes the testicle (or testicles) containing the cancer. An incision is made in the groin, and the testicle is moved through the opening.

Radical lymph node dissection – a surgical procedure to remove most or all of the lymph nodes in the area around the cancerous tumor.

Radical mastectomy – surgical removal of the breast, the pectoralis major and minor, all the axillary lymph nodes, and some additional fat and skin.

Radical neck dissection – during the surgery to remove the voice box, all the lymph nodes in the neck are removed. Additionally, the internal jugular vein, the spinal accessory nerve, and the sternocleidomastoid muscle are removed. If any one of these structures can be spared, the procedure is referred to as a modified radical neck dissection.

Radical nephrectomy – surgical removal of an entire kidney, nearby adrenal gland and lymph nodes, and other surrounding tissue.

Radical perineal prostatectomy – surgical removal of all of the prostate through an incision between the scrotum and the anus (perineum). It is typically performed to remove early prostate cancer. Radical perineal prostatectomy is less commonly used than another surgery such as the open radical retropubic prostatectomy or the robot assisted laparoscopic radical retropubic prostatectomy. Lymph nodes can be sampled through the same incision, although this procedure is not common place in the U.S. at this time. When the cancer is small and confined to the prostate, radical perineal prostatectomy achieves the same rate of cure as the retropubic approach but less blood is lost and recovery is faster.

Radical retropubic prostatectomy – surgical removal of all the prostate and nearby lymph nodes through an incision in the wall of the abdomen.

Radical trachelectomy – surgical removal of the cervix, parametrium (tissue immediately next to the cervix) and the upper two centimeters of the vagina, but does not remove the uterus. The uterus then is connected to the remaining portion of the upper vagina. Radical trachelectomy is like a radical hysterectomy, but it leaves a woman's uterus (womb) intact. After the procedure, many women can conceive and deliver full-term babies.

Radioactive iodine – uses large doses of a form of iodine that's radioactive. Radioactive iodine treatment is often used after thyroidectomy to destroy any remaining healthy thyroid tissue, as well as microscopic areas of thyroid cancer that weren't removed during surgery. Radioactive iodine treatment may also be used to treat thyroid cancer that recurs after treatment or that spreads to other areas of the body. Radioactive iodine treatment comes as a capsule or liquid that you swallow. The radioactive iodine is taken up primarily by thyroid cells and thyroid cancer cells, so there's a low risk of harming other cells in your body.

Range of motion (ROM) – the range that a bodily segment moves during a particular exercise.

Recipient – one who receives blood, tissue, or an organ from a donor.

Rectal – of, relating to, or situated near the rectum.

Rectal cancer – cancer that forms in the tissues of the rectum.

Rectal reconstruction – surgery to rebuild the rectum, following its removal, using a section of the colon.

Recurrent cancer – is defined as the return of cancer after treatment and after a period of time during which the cancer cannot be detected.

Red blood cell (erythrocyte) – are the most common type of blood cell and the principal means of delivering oxygen (O2) to the body tissues via the blood flow through the circulatory system.

Reed-Sternberg cell – a giant binucleated cell that appears in people with Hodgkin disease.

Regional – an area of the body immediately surrounding the tumor.

Regional lymph node – a lymph node that drains lymph from the area immediately surrounding the tumor.

Regional lymph node dissection – removal of some of the lymph nodes in the area immediately surrounding the tumor.

Registered dietitian – is an expert in food and nutrition. They advise people on what to eat in order to lead a healthy lifestyle or achieve a specific health-related goal.

Rehabilitation – to restore to good health and function, following an injury or disease, through therapy and education.

Relapse – a recurrence of a past medical condition.

Remission – is a period where you are deemed to have no detectable, or very little detectable cancer in your body.

Renal cell carcinoma – is the most common type of kidney cancer in adults. It begins in the renal tubules and occurs most often in men ages 50 – 70.

Renal cortical tumors – cancer that arises in the main part of the kidney that contains the renal tubules.

Renal failure – is a medical condition in which the kidneys fail to adequately filter toxins and waste products from the blood. The two forms are acute (acute kidney injury) and chronic (chronic kidney disease); a number of other diseases or health problems may cause either form of renal failure to occur

Renal lithiasis – kidney stones

Renal tubular acidosis - is a medical condition that involves an accumulation of acid in the body due to a failure of the kidneys to appropriately acidify the urine.

Reproductive system – is a system of organs which work together for the purpose of reproduction. The organs involved in producing offspring. In women, this system includes the ovaries, the fallopian tubes, the uterus, the cervix, and the vagina. In men, it includes the prostate, the testes, and the penis.

Resectable – able to be removed by surgery.

Resected – removed by surgery.

Resection – removal of all or part of an organ, tissue, or structure.

Resorption – a process in which a substance is lost by being destroyed and then absorbed by the body.

Respirator (ventilator) – a machine that is used to help a patient breathe.

Respiratory failure – is inadequate gas exchange by the respiratory system, with the result that levels of arterial oxygen, carbon dioxide or both cannot be maintained within their normal ranges.

Respiratory gating – without respiratory gating, doctors often deliver radiation to the entire area that a tumor moves through as the patient breathes, ensuring that the tumors gets proper dosing, but also delivering radiation to areas with healthy tissue. Respiratory gating software eliminates the need to apply radiation with such broad strokes, instead focusing radiation on the tumor, and sparing more healthy tissue. This is particularly useful for tumors near the lungs, where radiation-induced scarring can impair future breathing.

Respiratory therapist – is a health care professional that specializes in the promotion of optimum cardiopulmonary function and health.

Respiratory therapy – is the health care discipline that specializes in the promotion of optimum cardiopulmonary function and health.

Restrictive cardiomyopathy – is a rare form of heart muscle disease that is characterized by restrictive filling of the ventricles. In this disease the contractile function (squeeze) of the heart and wall thicknesses are usually normal, but the relaxation or filling phase of the heart is very abnormal.

Restrictive lung disease - refers to a group of lung diseases that prevent the lungs from fully expanding with air.

Retroperitoneal – is the anatomical space in the abdominal cavity behind the peritoneum.

Retroperitoneal lymph node dissection – surgical removal of the retroperitoneal lymph nodes behind the abdomen.

Retropubic prostatectomy – surgery to remove part, or all, of the prostate and some of the tissue around it through an incision in the wall of the abdomen. Nearby lymph nodes may also be removed.

Rhabdomyosarcoma – is usually found in the thigh, shoulder, and upper arm. It may be large when found. It tends to spread to the lymph nodes. Rhabdomyosarcoma usually affects people in their 40's and 50's.

Rheumatoid arthritis (RA) – is a long-term disease that leads to inflammation of the joints and surrounding tissues.

Rhinorrhea - is a condition where the nasal cavity is filled with a significant amount of mucus fluid. The condition, commonly known as a runny nose, occurs relatively frequently.

Rickets – is a disorder caused by a lack of vitamin D, calcium, or phosphate. It leads to softening and weakening of the bones. Symptoms: Bone pain or tenderness in the arms, legs, pelvis, and spine.

Room air desaturation – below 70% puts clients at risk for dysrhythmia, hemodynamic decompensation, hypoxic brain injury, and death.

Rothmund-Thomson syndrome - is a rare condition that affects many parts of the body, especially the skin, eyes, bones, and teeth. Signs and symptoms can include a characteristic facial rash (poikiloderma); sparse hair, eyelashes, and/or eyebrows; short stature; skeletal (bone) and dental abnormalities; cataracts; premature aging; and an increased risk for cancer, especially osteosarcoma.

Sacrum – is a shield-shaped bony structure that is located at the base of the lumbar vertebrae and that is connected to the pelvis.

Salpingo-oophorectomy – surgical removal of the fallopian tubes and ovaries.

Sarcoma – cancer of the bone, cartilage, fat, muscle, blood vessels, or connective tissue. Both children and adults can develop a sarcoma. It can start in any part of the body, such as the bone or soft tissue. About 60% begin in an arm or leg, 30% start in the trunk or abdomen, and 10% are in the head or neck. Sarcoma is rare in adults, accounting for about 1% of all adult cancers. However, sarcoma in general represents about 15% of all cancers in children.

Scapula (shoulder blade) – either of two large, flat, triangular bones forming the back part of the shoulder.

Scar tissue – is thick, dense tissue that appears after injuries.

Scleral icterus – jaundice in the white part of the eye.

Scleroderma - is a group of rare diseases that involve the hardening and tightening of the skin and connective. In some people, scleroderma affects only the skin.

Scoliosis – an abnormal curvature of the spine. Scoliosis may be present at birth but may also occur at some point in time after radiation therapy to the backbone.

Scrotum – the external sac that contains the testicles and is located behind the penis.

Second primary cancer – is a new primary cancer developing in a person with a history of cancer in a new site or tissue and subsequent to the initial cancer.

Second-line therapy – treatment that is given when initial treatment s either unsuccessful, or stops working altogether.

Second-look surgery – is performed after a procedure or course of treatment to determine if the patient is free of disease.

Secondary cancer – can refer either to a second primary cancer, or to cancer that has spread from one part of the body to another (metastatic cancer).

Secondhand smoke (passive smoking) – is smoke that comes from the burning of a tobacco product and smoke that is exhaled by smokers. Secondhand smoke is a serious health hazard causing close to 50,000 deaths per year. It can cause or exacerbate a wide range of adverse health effects, including lung cancer, respiratory infections, and asthma

Secrete – to produce or discharge.

Sedation – is the act of calming by administration of a sedative. A sedative is a medication that commonly induces the nervous system to calm.

Segmental (partial) cystectomy – surgery to remove part of the bladder.

Segmental mandibulectomy – if the x-ray shows the tumor has grown into the jaw bone, a whole portion of the mandible will need to be removed. The removed piece of the jaw can then be replaced with a piece of bone from another part of the body, such as the fibula, hip bone, or the shoulder blade. Depending on the situation, sometimes a metal plate or a piece of bone from a donor may be used instead.

Segmental (partial) mastectomy – surgery to remove the cancerous portion of the breast, a wedge of normal tissue around it, and the lining over the chest muscles below the cancer. Sometimes lymph nodes under the arm may also be removed. It is a type of breast-conserving surgery.

Segmental resection – a surgical procedure to remove all or part of a gland.

Sentinel lymph node – is the first lymph node reached by cancer cells metastasizing from a tumor.

Sentinel lymph node biopsy – using a blue dye and a special radioactive substance that can be traced using imaging techniques, doctors can identify during surgery the first lymph node (the sentinel node) to which cancer cells would travel.

SERM (selective estrogen receptor modulator) – block the effects of estrogen in the breast tissue. SERMs work by occupying the estrogen receptors in breast cells. If a SERM is in the estrogen receptor, there is no room for estrogen and it can't attach to the cell. If estrogen isn't attached to a breast cell, the cell doesn't receive estrogen's signals to grow and multiply. Tamoxifen and raloxifene are SERMs.

Sertoli cell tumors – these tumors develop from normal Sertoli cells, which support and nourish the sperm-producing germ cells. Like the Leydig cell tumors, they are usually benign.

Sharp mesorectal incision – a procedure for cancers that have grown through the wall of the rectum or involve the lymph nodes which may require more extensive surgery. This approach allows the delicate removal of all cancerous tissue in and around the rectum, but carefully avoids severing the nerves that are involved in sexual and urinary function and allows most clients to avoid a permanent colostomy.

Shave biopsy – a procedure in which a skin abnormality and a thin layer of surrounding skin are removed with a small blade for examination under a microscope. Stitches are not needed with this procedure.

Short-term side effect – a problem that is caused by treatment of a disease or illness. It is typically acute rather than chronic. Short-term side effects of cancer treatment include nausea, vomiting, diarrhea, hair loss, fatigue, weight loss, weight gain, sleeplessness, and mouth sores.

Shoulder blade (scapula) – one of a pair of triangular bones at the back of the shoulder. It is the bone that connects the upper arm with the collarbone.

Shunt – a passage that is made to allow blood, food, or air to move from one part of the body to another.

Side effect – a problem that is caused by treatment of a disease or illness. Side effects may be short-term (acute), or long-term (chronic).

Sigmoid colon – is the "S" shaped part of the large intestine that is closest to the rectum and anus.

Simple (total) mastectomy – surgery to remove the entire breast and surrounding tissue. Some of the lymph nodes under the arm may also be removed.

Simple nephrectomy – surgery to remove one kidney.

Sinus – is a cavity within a bone or other tissue. Most commonly found in the bones of the face and connecting with the nasal cavities.

Sinusoidal Obstruction Syndrome - previously known as veno-occlusive disease (VOD), is a distinctive and potentially fatal form of hepatic injury that occurs predominantly, if not only, after drug or toxin exposure.

Sinus tachycardia – a resting heart rate greater than 100 beats per minute in an average adult – originates from the sinoatrial node (the heart's electrical pacemaker).

Skeletal – having to do with the bones of the body (skeleton).

Skeletal metastases – spread of cancer to the bones.

Skeleton – an internal or external framework of bone, cartilage, or other rigid material supporting or containing the body of an animal or plant. It is made up of about 206 bones.

Skin cancer – is named after the type of skin cell from which it arises. Basal cell cancer originates from the lowest layer of the epidermis, and is the most common but least dangerous skin cancer. Squamous cell cancer originates from the middle layer, and is less common but more likely to spread and, if untreated, become fatal. Melanoma, which originates in the pigment-producing cells (melanocytes), is the least common, but most aggressive, most likely to spread and, if untreated, become fatal.

Skin graft – is a patch of skin that is removed by surgery from one area of the body and transplanted, or attached, to another area.

Skin-sparing mastectomy – is performed to facilitate immediate breast reconstruction. Skin-sparing mastectomy incisions are smaller than those required for a modified radical or simple mastectomy. Most of the breast tissue is removed, but most of the breast skin is saved to hold and shape the reconstructed breast. In a skin-sparing mastectomy, the incision is made around the areola. Sometimes it is necessary to make another incision extending down or to the side to remove as much breast tissue as possible.

Skip metastasis – a tumor or nodule located in the same bone as the main tumor, but not in continuity with the tumor.

Sleeve pneumonectomy – surgical removal of the entire lung as well as lower trachea. The airway must be reconstructed following this procedure.

Sleeve resection - may be used to treat some cancers in large airways in the lungs. A surgeon may be able to do this operation instead of a pneumonectomy to preserve more lung function.

Small bowel resection – surgical removal of the cancer part of the intestine.

Small cell lung cancer – the fastest growing type of lung cancer that forms in tissues of the lung and can spread to other parts of the body. It spreads more quickly than non-small cell lung cancer.

Small intestine – is the part of the gastrointestinal tract following the stomach and followed by the large intestine, and is where much of the digestion and absorption of food takes place.

Small intestine cancer – cancer that forms in tissues of the small intestine.

Soft palate – soft tissue constituting the back of the roof of the mouth.

Soft tissue – refers to tissues that connect, support, or surround other structures and organs of the body, not being bone. Soft tissue includes tendons, ligaments, fascia, skin, fibrous tissues, fat, and synovial membranes (which are connective tissue), and muscles, nerves and blood vessels (which are not connective tissue).

Soft tissue sarcoma – are cancerous tumors that originate in the soft tissues of the body.

Solid tumor – an abnormal mass of tissue that usually does not contain cysts or liquid areas.

Sonogram – a diagnostic medical image created using ultrasound echo (sonographic) equipment.

Spacial frame technique (taylor special frame) – is a versatile multiplanar external fixator that combines ease of application with computer accuracy to effectively reduce fractures and correct all aspects of deformity in reconstructive orthopoedic surgery

Spasm – a sudden, involuntary contraction of a muscle or group of muscles.

Spasticity - is a velocity-dependent increase in muscle tone and uncontrolled, repetitive, involuntary contractions of skeletal muscles. It presents as upper motor neuron symptoms in patients with central nervous system pathology such as stroke, spinal cord injury, brain injury, or multiple sclerosis.

Speculum – an instrument for opening or distending a body orifice or cavity to permit visual inspection

Spermatocytic seminoma – this rare type of seminoma tends to occur in older men. The average age of men diagnosed with spermatocytic seminoma is about 65. Spermatocytic tumors tend to grow more slowly and are less likely to spread to other parts of the body than classical seminomas.

Sphincter – a ring like muscle that normally maintains constriction of a body passage or orifice and that relaxes as required by normal physiological functioning.

Spinal block – is a safe and effective alternative to general anesthesia when the surgical site is located on the lower extremities.

Spinal (vertebral) column – a series of articulated vertebrae, separated by intervertebral disks and held together by muscles and tendons, that extends from the cranium to the coccyx or the end of the tail, encasing the spinal cord and forming the supporting axis of the body; the spine.

Spinal cord – the long, cordlike part of the central nervous system that is enclosed within the vertebral column (spine) and descends from the base of the brain, with which it is continuous. The spinal cord branches to form the nerves that convey motor and sensory impulses to and from the tissues of the body.

Spinal cord compression – develops when the spinal cord is compressed by bone fragments from a vertebral fracture, a tumor, abscess, ruptured intervertebral disc, or other lesion. It is regarded as a medical emergency independent of its cause, and requires swift diagnosis and treatment to prevent long-term disability due to irreversible spinal cord injury.

Spinal tap (lumbar puncture) – is a procedure to collect and look at the cerebrospinal fluid surrounding the brain and spinal cord. During a lumbar puncture, a needle is carefully inserted into the spinal canal low in the back. Samples of CSF are collected and studied for color, blood cell counts, protein, glucose, and other substances. Some of the sample may be put into a special culture cup to see if any infection, such as bacteria or fungi, grows. The pressure of the CSF also is measured during the procedure

Spleen – a large, highly vascular lymphoid organ, lying in the human body to the left of the stomach below the diaphragm, serving to store blood, disintegrate old blood cells, filter foreign substances from the blood, and produce lymphocytes. Removal of the spleen may make a patient more prone to infection.

Splenectomy – a surgical procedure to remove the spleen.

Splenomegaly – abnormal enlargement of the spleen.

Squamous cell carcinoma – is a cancer of a kind of epithelial cell, the squamous cell. These cells are the main part of the epidermis of the skin, and this cancer is one of the major forms of skin cancer. However, squamous cells also occur in the lining of the digestive tract, lungs, and other areas of the body, and SCC occurs as a form of cancer in diverse tissues, including the lips, mouth, esophagus, urinary bladder, prostate, lung, vagina, and cervix, among others. Despite sharing the name squamous cell carcinoma, the SCCs of different body sites can show tremendous differences in their presenting symptoms, natural history, prognosis, and response to treatment.

Stabilizers – are muscles that support or stabilize the body while the prime movers and the synergists perform the movement patterns.

Stage – how much cancer there is in the body and where it is located.

Staging – describes the extent or severity of an individual's cancer based on the extent of the original (primary) tumor and the extent of spread in the body. Knowing the stage of the disease helps the doctor plan a treatment and determine a prognosis

Staging system – a system that is used to describe the extent of cancer in the body.

Stamina – strength of physical constitution, ability to endure physical activity, stress, or disease over time.

Static Posture – any posture that is held for a long time.

Static stretching – is used to stretch muscles while the body is at rest. It is composed of various techniques that gradually lengthen a muscle to an elongated position (to the point of discomfort) and hold that position for 30 seconds to two minutes.

Stem cell – cell found in most, if not all, multi-cellular organisms. It is characterized by the ability to renew itself through mitotic cell division and differentiating into a diverse range of specialized cell types.

Stem cell mobilization – G-CSF is a hormone that stimulates the bone marrow to grow very rapidly; when this occurs, stem cells move out into the blood stream in large numbers. The stem cells can be collected and stored for use at a later time. They may be used later to replace the bone marrow during a stem cell transplant.

Stem cell transplant – a procedure for replacing immature blood-forming cells in the bone marrow that have been destroyed by drugs, radiation, or disease. Stem cells are collected and then injected into the patient. The stem cells stimulate the production of healthy blood cells. Cells may be taken directly from the patient (autologous), from a donor who is genetically compatible (allogeneic), or from an identical twin (syngeneic).

Stent – is a mesh 'tube' inserted into a natural passage/conduit in the body to prevent or counteract a disease-induced, localized flow constriction. The term may also refer to a tube used to temporarily hold such a natural conduit open to allow access for surgery.

Stereotactic biopsy – is a biopsy procedure that uses a computer and imaging performed in at least two planes to localize a target lesion in three-dimensional space and guide the removal of tissue for examination by a pathologist under a microscope.

Stereotactic external-beam radiation therapy – uses focused radiation beams targeting a well-defined tumor, relying on detailed imaging, computerized three-dimensional treatment planning and precise treatment set-up to deliver the radiation dose with extreme accuracy.

Stereotactic radiosurgery – a type of external radiation therapy that uses special equipment to position the patient and precisely deliver radiation to a tumor. The total dose of radiation is divided into several smaller doses given over several days.

Stereotactic radiation therapy - is used to treat brain tumors and other brain disorders. It is also being studied in the treatment of other types of cancer, such as lung cancer.

Sterile – a term referring to any process that eliminates or kills all forms of life from an item or field. May also be the condition of a person being unable to bear children; especially through natural means.

Sternum (breastbone) – a plate of bone forming the middle of the anterior wall of the thorax and articulating with the clavicles and the cartilages of the first seven ribs. It consists of three parts, the manubrium, the body, and the xiphoid process.

Sternotomy – the doctor may split the sternum through its midline in order to see both sides of chest to locate undetected cancer. In some cases, the doctor will also remove a small portion of the lung.

Steroid – any of numerous naturally occurring or synthetic fat-soluble organic compounds having as a basis, 17 carbon atoms arranged in four rings and including the sterols and bile acids, adrenocortical and sex hormones, certain natural drugs such as digitalis compounds, and the precursors of certain vitamins.

Steroidogenesis - is the multistep process for biosynthesis of steroid hormones from cholesterol.

Stoma - any opening in the body. For example, a mouth, a nose, and an anus are natural stomata. Any hollow organ can be manipulated into an artificial stoma as necessary. This includes the esophagus, stomach, duodenum, ileum, colon, pleural cavity, ureters, urinary bladder, and renal pelvis.

Stomach – the food reservoir and first major site of digestion; located just under the diaphragm and divided into a body and a pylorus. It receives partially processed food and drink funneled from the mouth through the esophagus and gradually feeds liquefied food (chyme) into the small intestine. The stomach lies in the epigastric and left hypogastric regions bounded by the anterior abdominal wall and the diaphragm between the liver and the spleen.

Stomach (gastric) cancer – cancer that forms in tissues lining the stomach.

Stomatitis - is inflammation of the mouth and lips

Strength – bodily or muscular power.

Stroke – occurs when blood flow is interrupted to part of the brain. Without blood to supply oxygen and nutrients and to remove waste products, brain cells quickly begin to die. Depending on the region of the brain affected, a stroke may cause paralysis, speech impairment, loss of memory and reasoning ability, coma, or death.

Stromal tumors – tumors can also develop in the supportive and hormone-producing tissues, or stroma, of the testicles. These tumors are known as gonadal stromal tumors. They make up less than 5% of adult testicular tumors but up to 20% of childhood testicular tumors. The two main types are Leydig cell tumors and Sertoli cell tumors. Subclavian artery - the left subclavian artery supplies blood to the left arm and the right subclavian artery supplies blood to the right arm, with some branches supplying the head and thorax.

Subcutaneous – situated or lying underneath the skin.

Subcutaneous emphysema - is when gas or air is in the layer under the skin

Subcutaneous mastectomy – is a type of skin-sparing mastectomy which removes tissue through an incision under the breast, leaving the skin, areola, and nipple intact. Some women who have prophylactic mastectomies prefer a subcutaneous procedure because it retains their nipples and offers very good cosmetic results. By working through the incision under the breast, the new breast is reconstructed without visible scars. Because a subcutaneous mastectomy leaves more tissue behind—working through the incision under the breast makes it impossible to remove as much tissue as a simple or modified radical mastectomy. This procedure is considered appropriate only as a prophylactic measure.

Subcutaneous port – is a tube surgically placed into a blood vessel and attached to a disk placed under the skin. It is used for the administration of intravenous fluids and drugs; it can also be used to obtain blood samples.

Subjective improvement – an improvement that is reported by the patient but cannot be measured against a norm.

Subtotal (partial) hysterectomy – is a procedure in which a woman's uterus is removed but the cervix is left in place.

Subtotal nodal irradiation – radiation to both the mantle and abdominal field.

Supraventricular arrhythmias – early extra beats that originate in the upper chamber of the heart.

Sutent® (Sunitinib) – blocks several tyrosine kinases, but not the same ones as sorafenib. This drug is a pill that has been shown to shrink or slow the progression of kidney cancer in many cases. It attacks both blood vessel growth and other targets that stimulate cancer cell growth.

Superficial – lying on, not penetrating below, or affecting only the surface.

Superior – the opposite of inferior. A position about a specific reference point.

Superior vena cava – is a large diameter, yet short, vein that carries deoxygenated blood from the upper half of the body to the heart's right atrium.

Supination – the opposite of pronation. The rotation of the forearm and hand so that the palm faces forward or upward; also: a corresponding movement of the foot and leg in which the foot rolls outward with an elevated arch.

Supine – the opposite of prone. Lying on one's back.

Supraclavicular lymph node – a lymph node found superior to the clavicle.

Supraglottic (horizontal partial) laryngectomy – is a surgical technique designed with the goal of complete elimination of cancer arising from the epiglottis, aryepiglottic folds, and false vocal cords while minimizing morbidity and maintaining the three primary functions of the larynx—airway protection, respiration, and phonation.

Supraglottis – the area of the pharynx above the glottis as far as the epiglottis.

Survival rate – is a part of survival analysis, indicating the percentage of people in a study or treatment group who are alive for a given period of time after diagnosis. Survival rates are important for prognosis.

Sympathetic nervous system – the part of the nervous system that is continuously active to maintain stability, temperature, and pH of the body. Primarily, this nervous system counteracts parasympathetic nervous system. This system also helps in controlling the internal organs of the body such as eyes, heart, lungs, blood vessels, sweat glands, digestive system, kidney, and penis. Dilation of pupils, rate and force of contraction, dilation of bronchioles, constriction of blood vessels, activation of sweat secretion, inhibition of peristalsis, promotion of renin secretion, and promotion of ejaculation in men are all aided by this nervous system. increases heart rate, blood pressure, breathing rate, and pupil size. It also causes blood vessels to narrow and decreases digestive juices.

Symptom – subjective evidence of disease or physical disturbance; something that indicates the presence of a bodily disorder.

Syncope – fainting or passing out

Synergistic – producing synergy; two drugs combining to give the user the same type of experience while building off of each other.

Synergists – are muscles that assist prime movers during functional movement patterns.

Synergistic dominance – this is the process in which a synergist compensates for a prime mover to maintain force production.

Synovial fluid – a clear fluid secreted by membranes in joint cavities, tendon sheaths, and bursae, and functioning as a lubricant.

Synovial sarcoma – is a malignant tumor of the tissue around joints. The most common locations are the hip, knee, ankle, and shoulder. This tumor is more common in children and young adults, but it can occur in older people.

Synthetic – not of natural origin.

Systemic chemotherapy – uses anticancer drugs, either injected into a vein or given by mouth, that travel through the blood to cells all over the body.

Systemic disease – is a disease that affects a number of organs and tissues, or affects the body as a whole.

Systemic radiation therapy – radioactive material is injected or ingested and travels throughout the body and is absorbed by cancer cells.

Systemic therapy – any treatment that uses substances that will travel through the bloodstream, seeking out and affecting cells throughout the body.

T-cell - a lymphocyte of a type produced or processed by the thymus gland and actively participating in the immune response.

T-cell depleting monoclonal antibody - depletion of graft T cells is an effective way of reducing the incidence of acute and chronic GVHD.

Tachycardia – rapidly beating heart; usually defined as greater than 100 beats per minute.

Tachyarrhythmia's – abnormal heart rhythms with a ventricular rate of 100 or more beats per minute. Signs and symptoms related to the tachyarrhythmia may include shock, hypotension, heart failure, shortness of breath, chest pain, acute myocardial infarction, palpitations, and/or decreased level of consciousness.

Tagraxofusp-erzs (ElzonrisTM) - targeted therapy for Blastic Plasmacytoid Dendritic Cell Neoplasm and First CD123-Targeted Therapy

Takotsubo cardiomyopathy – also known as Takotsubo syndrome, is a temporary condition where your heart muscle becomes suddenly weakened or 'stunned'. The left ventricle, one of the heart's chambers, changes shape and enlarges.

Tamoxifen® – attaches to the hormone receptor in the cancer cell, blocking estrogen from attaching to the receptor. Since hormone-receptor positive cells need estrogen to grow, tamoxifen can slow or stop the growth of cancer cells. Unlike aromatase inhibitors, tamoxifen can be used to treat breast cancer in both premenopausal and postmenopausal women.

Tarceva® (Erlotinib) – works by not allowing EGFR (epidermal growth factor receptor this helps the cells divide and is mutated in about 10% of clients with non-small cell lung cancer and in nearly 50% of lung cancers arising in those who have never smoked). While potentially effective in many kinds of clients, it has been shown to be more likely to work for those who have never smoked or in younger women.

Targeted therapy – is a type of treatment that blocks the growth of cancer cells by interfering with specific targeted molecules needed for carcinogenesis and tumor growth, rather than by simply interfering with all rapidly dividing cells . Radiotherapy is not considered a 'targeted therapy' despite it being often aimed at the tumors. Targeted therapy may have fewer side effects than other types of cancer treatments.

Taxotere® (Docetaxel) – damages the structure of prostate cancer cells, is considered the standard of care in chemotherapy for men with prostate cancer that is resistant to hormone therapy.

Telangiectasias (spider veins) - are small dilated blood vessels near the surface of the skin or mucous membranes, measuring between 0.5 and 1 millimeter in diameter. These dilated blood vessels can develop anywhere on the body but are commonly seen on the face around the nose, cheeks, and chin.

Tendon – is a tough band of fibrous connective tissue that usually connects muscle to bone and is capable of withstanding tension.

Teratomas – are germ cell tumors with areas that look like each of the 3 layers of a developing embryo (the endoderm, mesoderm, and ectoderm) when seen under a microscope. The 3 main types of these tumors are the mature teratoma, immature teratoma, and teratoma with malignant transformation. Mature teratomas are tumors formed by cells like cells of adult tissues. They are generally benign and can usually be cured with surgery. Immature teratomas are less well-developed cancers with cells that look like those of an early embryo. Unlike mature teratomas, this type is more likely to grow and to metastasize outside of the testicle. Teratoma with malignant transformation is a very rare cancer. These cancers have some areas that look like mature teratomas but have other areas where the cells have become a type of cancer that develops outside of the testicle, in tissues such as muscles, glands of the lungs or intestines, or the brain.

Terminal disease – a disease that cannot be cured or adequately treated and that is reasonably expected to result in the death of the patient within a short period of time.

Testicle (testes) – either of the two oval organs that produce sperm in men and other male mammals, enclosed in the scrotum behind the penis.

Testicular cancer – cancer originating in the tissue of one or both testicles. Testicular cancer is most common in men age 15-34.

Testosterone – is a steroid hormone from the androgen group. It plays a key role in the development of male reproductive tissues such as the testis and prostate as well as promoting secondary sexual characteristics such as increased muscle, bone mass, and the growth of body hair. In addition, testosterone is essential for health and well-being as well as the prevention of osteoporosis.

Thalamus – is a large, dual lobed mass of grey matter buried under the cerebral cortex. It is involved in sensory perception and regulation of motor functions. The thalamus is a limbic system structure and it connects areas of the cerebral cortex that are involved in sensory perception and movement with other parts of the brain and spinal cord that also have a role in sensation and movement. As a regulator of sensory information, the thalamus also controls sleep and awake states of consciousness.

Therapeutic – a consequence of a medical treatment of any kind, the results of which are judged to be desirable and beneficial.

Therapy – is the attempted remediation of a health problem, usually following a diagnosis.

Thoracentesis – is a procedure to remove fluid from the space between the lining of the outside of the lungs (pleura) and the wall of the chest.

Thoracic – pertaining to the thorax (chest).

Thoracic spine – the 12 vertebrae in mid-torso that are attached to the rib cage.

Thoracoscope – an endoscope for examining the pleural cavity through an intercostal space.

Thoracoscopy – is a medical procedure involving internal examination, biopsy, and/or resection of disease or masses within the pleural cavity and thoracic cavity.

Thoracotomy – surgery to remove all or part of a lung.

Thoracotomy pain syndrome – continued pain and discomfort that can last from a few years to a lifetime. Treatment to aid pain relief for this condition includes intra thoracic nerve blocks/opiates and epidurals although results vary from person to person and are dependent on many factors.

Throat – is the anterior part of the neck, in front of the vertebral column. It consists of the pharynx and larynx.

Throat (pharyngeal) cancer – cancer that originates in the tissue of the throat.

Thrombocyte (platelet) – gathers at the wound and attempt to block the blood flow when bleeding suddenly occurs.

Thrombocytopenia – a relative decrease in the platelets of the blood.

Thrombosis – is the formation of a blood clot inside a blood vessel, obstructing the flow of blood through the circulatory system.

Thyroglobulin – one of the largest proteins in the body. This protein is found only in the thyroid gland. Thyroglobulin combines with iodine and is modified and broken down to release small molecules known as thyroid hormones. Thyroid hormones play an important role in regulating growth, brain development, and metabolism. Thyroglobulin also serves as a protein storehouse for iodine and inactive thyroid hormone until these substances are needed.

Thyroid (thyroid gland) – is a butterfly-shaped organ and is composed of two cone-like lobes or wings, connected via the isthmus. It is one of the largest endocrine glands. The thyroid gland is found in the neck, below the thyroid cartilage. The thyroid gland controls how quickly the body uses energy, makes proteins, and controls how sensitive the body is to other hormones.

Thyroid cancer – cancer originating in the tissue of the thyroid.

Thyroid hormone – hormones produced by the thyroid gland that are primarily responsible for regulation of metabolism. This includes heart rate, blood pressure, body temperature, and weight. Thyroid hormone is made by the thyroid gland, but can also be made artificially in the laboratory. Natural thyroid hormone supplements from the dried thyroids of animals are still available. Natural thyroid hormones have become less popular, due to evidence that varying hormone concentrations in the thyroids of animals before they are slaughtered leads to inconsistent potency and stability.

Thyroid hormone treatment – treatment with natural or artificial thyroid hormone.

Thyroid-stimulating hormone (TSH) – is a hormone that stimulates the thyroid gland to produce thyroxin (T4), and then triiodothyronine (T3) which stimulates the metabolism of almost every tissue in the body.

Thyroidectomy – a surgical procedure that involves the removal of all or part of the thyroid gland.

Thyrotoxicosis – excess of thyroid hormone in the body. Having this condition also means that you have a low level of thyroid stimulating hormone, TSH, in your bloodstream, because the pituitary gland senses that you have “enough” thyroid hormone.

Thyroxin – a hormone of the thyroid gland that contains iodine and is a derivative of the amino acid tyrosine.

Tibia (shinbone) – the inner and larger of the two bones of the lower human leg; extending from the knee to the ankle.

Tinnitus - is the perception of noise or ringing in the ears. A common problem, tinnitus affects about 1 in 5 people. Tinnitus isn't a condition itself, it's a symptom of an underlying condition, such as age-related hearing loss, ear injury or a circulatory system disorder.

Tissue – an aggregate of cells, usually of a particular kind together with their intercellular substance, that form one of the structural materials of a plant, animal, or human and that in humans and animals include connective tissue, epithelium, muscle tissue, and nerve tissue.

Tissue flap reconstruction – is a way to rebuild the shape of a breast using skin, fat, and muscle from another part of the body. It is usually done after part, or all, of the breast is removed because of cancer.

TNM staging system – is a cancer staging system that describes the extent of cancer in a patient’s body. T describes the size of the tumor and whether it has invaded nearby tissue, N describes regional lymph nodes that are involved, and M describes distant metastasis.

Tobacco – is an agricultural product processed from the leaves of plants in the genus Nicotiana. It can be consumed, used as a pesticide and, in the form of nicotine tartrate, used in some medicines.[1] It is most commonly used as a drug, and is a valuable cash crop for countries such as Cuba, India, China, and the United States.There are over 4,000 chemicals in cigarettes; 51 of them are known to be carcinogenic. Chew, snuff, and other types of smokeless tobacco are known to increase risk for oral cancer.

Tongue cancer – is a common and serious type of oral cancer. Tongue cancer usually begins in the squamous cells that cover the surface of the tongue. When cancer forms in the front two-thirds of the tongue, it's classified as a type of oral cancer. Cancer that develops in the back third of the tongue is considered a form of throat (oropharyngeal) cancer.

Tonsil – either of two small masses of lymphoid tissue in the throat, one on each side of the root of the tongue.

Topical – of, pertaining to, or applied externally to a particular part of the body; local.

Torisel® (Temsirolimus) – is given as an intravenous infusion. It works by blocking a cell protein known as mTOR, which normally promotes cell growth and division. This drug has been shown to be helpful against advanced kidney cancers that have a poorer prognosis because of certain factors.

Total-body irradiation – gives a dose of radiation to the whole body to destroy cancer cells throughout the body.

Total (complete) hysterectomy – surgery to remove the uterus and the cervix.

Total laryngectomy – a surgical procedure to remove the larynx (voice box).

Total (simple) mastectomy – surgical removal of the entire breast and usually a few lymph nodes that are located in the breast tissue.

Total nodal irradiation – irradiation of the entire trunk.

Total pancreatectomy – is the surgical removal of the pancreas. It is unusual to do and is only done when disease involves the entire pancreas and no other surgical options are available. Part of the stomach, part of the small intestine, the duodenum, a small part of the jejunum, the common bile duct, the gallbladder, the spleen, and nearby lymph nodes are also removed.

Total thyroidectomy – surgery to remove the entire thyroid.

Toxic – containing poisonous material; capable of causing death or serious debilitation.

Toxicity – the degree to which a substance can damage an organism.

Toxicology – is a branch of biology, chemistry, and medicine concerned with the study of the adverse effects of chemicals on living organisms. It is the study of symptoms, mechanisms, treatments and detection of poisoning, especially the poisoning of people.

Toxin – poisonous substance, especially a protein that is produced by living cells or organisms, and is capable of causing disease when introduced into the body.

Trachea (windpipe) – is a tube that connects the pharynx and larynx to the lungs, allowing the passage of air.

Trachelectomy (cervicectomy) – is a surgical removal of the uterine cervix. As the uterine body is preserved, this type of surgery is a fertility preserving surgical alternative to a radical hysterectomy and applicable in selected younger women with early cervical cancer.

Tracheoesophageal puncture – often the preferred choice for restoring speech. This is a one-day surgery which can be done as long as ten years after larynx surgery. Its' purpose is to give people who find it difficult to learn esophageal speech an opportunity to regain the use of their voices. An opening is made from the windpipe into the esophagus, and a small plastic valve is inserted to provide a source of air. The patient diverts air into the esophagus and uses it to resonate in the pharynx.

Tracheostomy – is a surgical procedure to create an opening through the neck into the trachea. A tube is usually placed through this opening to provide an airway and to remove secretions from the lungs. This tube is called a tracheostomy tube or trach tube.

Transanal endoscopic microsurgery (TEM) – this operation can sometimes be used for early T1 N0 M0 stage I cancers that are higher in the rectum that could not be reached using the standard transanal resection. A specially designed magnifying scope is inserted through the anus and into the rectum, allowing the surgeon to do a transanal resection with great precision and accuracy.

Transarterial embolization (TAE) – a catheter is used to find the artery feeding the tumor and a substance is injected into the blood vessel, cutting off the blood supply to the tumor. This kills the tumor.

Transcutaneous electrical nerve stimulation (TENS) – is the use of electric current produced by a device to stimulate the nerves for therapeutic purposes.

Transdermal – entering through the dermis, or skin, as in administration of a drug via ointment or patch.

Transfusion – the introduction of blood directly into an individual's blood circulation through a vein.

Transitional cell (urothelial) tumor – a type of kidney cancer that arises in the renal pelvis and is similar to bladder cancer.

Transplantation – a surgical procedure in which tissue or an organ is transferred from one body part to another.

Transurethral resection of the bladder tumor (TURBT) – a flexible cytoscope is inserted through the urethra and into the bladder (does not require cutting into the abdomen). An electrified wire loop is then passed through the scope. It is "heated up" and used to cut the tumor off the bladder wall, simultaneously coagulating the site to prevent bleeding. After surgery, more steps may be taken to try to ensure that the tumor has been completely destroyed. Any remaining cancer may be treated by burning the base of the tumor (fulguration) while looking at it with the cystoscope. Cancer can also be destroyed using the cystoscope and a high-energy laser. After transurethral surgery, the patient can usually return home the same day or the next day and can resume their usual activities in less than 2 weeks.

Transurethral resection of the prostate (TURP) – a palliative procedure in which an instrument is inserted up the urethra to remove the section of the prostate that is blocking urine flow.

Trauma – an injury to living tissue caused by an extrinsic agent. A disordered psychic or behavioral state resulting from severe mental or emotional stress or physical injury.

Treatment cycle – each cancer treatment is typically followed by a rest period of a few weeks to allow the body to recover from any side effects, and so the number of cells in the blood can go back to normal. The treatment and the rest period together make up the treatment cycle.

Treatment field – the area of the body that radiation beams are directed at during radiation therapy.

Triple-negative breast cancer – refers to any breast cancer that does not express the genes for estrogen receptor (ER), progesterone receptor (PR) or Her2/neu. Some types of triple negative breast cancer are known to be more aggressive with poor prognosis, while other types have prognosis very similar or better than hormone receptor positive breast cancers. Triple negative breast cancers have a relapse pattern that is very different from hormone-positive breast cancers: the risk of relapse is much higher for the first 3-5 years but drops sharply and substantially below that of hormone-positive breast cancers after that.

Trismus – lockjaw; is reduced opening of the jaws (limited jaw range of motion). It may be caused by spasm of the muscles of mastication or a variety of other causes.

TSH – is a hormone that stimulates the thyroid gland to produce thyroxine (T4), and then triiodothyronine (T3) which stimulates the metabolism of almost every tissue in the body.

Tubi-grip stocking – an elastic tubular support bandage that protects a port or central line.

Tumor – is an abnormal growth of body tissue. Tumors can be cancerous (malignant) or noncancerous (benign). Symptoms depend on the type and location of the tumor.

Tumor debulking – is a surgical procedure performed to remove as much of a tumor as is logistically possible. There are several factors that can influence the way this procedure is performed, including the type of tumor, location, and the patient's general health.

Tumor grade – is a way of classifying tumors based on certain features of their cells. The grade of a tumor is directly linked to prognosis. The more the cancer cells look like normal cells, the lower the tumor grade tends to be. Also, the fewer cancer cells that are in the process of dividing, the more likely it is that the tumor is slow-growing, which contributes to a lower tumor grade.

Tumor suppressor genes – normal genes that slow down cell division, repair DNA mistakes, or tell cells when to die – a process known as apoptosis or programmed cell death.

Ulcer – is a discontinuity or break in a bodily membrane that impedes the organ of which that membrane is a part of from continuing its normal functions.

Ulceration – the formation or development of an ulcer.

Ultrasonic aspiration – using a hand-held ultrasonic aspirator will produce high frequency sound waves that cause the lesion to vibrate and break apart while leaving nerves and blood vessels intact. The instrument simultaneously "vacuums" the remaining fragments of the tumor.

Ultrasound – uses high-frequency sound waves to look at organs and structures inside the body. Health care professionals use them to view the heart, blood vessels, kidneys, liver and other organs. During pregnancy, doctors use ultrasound tests to examine the fetus. Unlike x-rays, ultrasound does not involve exposure to radiation.

Ultrasound-guided biopsy – an ultrasound scanner is used to accurately guide a needle to the site of the biopsy. The needle will then be used to remove a tissue sample.

Unclassified – a type of renal cortical kidney cancer that makes up 3-5% of kidney tumors. These rare tumors look different under a microscope than other kidney cancer subtypes and are usually very aggressive.

Undifferentiated (anaplastic) – when cells are very immature and "primitive" and do not look like cells in the tissue from which it arose. Undifferentiated cancer is more malignant than a cancer of that type which is well differentiated.

Undifferentiated pleomorphic sarcoma – is most often found in the arms or legs. Less often, it can start inside at the back of the abdomen (the retroperitoneum). This sarcoma is most common in older adults. Although it mostly tends to grow locally, it can spread to distant sites.

Unresectable – cannot be surgically removed.

Unstable angina – is a condition in which your heart doesn't get enough blood flow and oxygen. It may lead to a heart attack.

Upper extremity – is the region extending from the deltoid region to the hand, including the arm, axilla and shoulder.

Upper-crossed syndrome – a dysfunctional muscle pattern that is characterized by a forward head and rounded shoulders.

Ureter – tubes made of smooth muscle fibers that propel urine from the kidneys to the urinary bladder.

Urethra – is a tube that connects the urinary bladder to the genitals for the removal of fluids from the body.

Uricemia – an abnormal amount of uric acid in the blood.

Urinalysis – is the physical, chemical, and microscopic examination of urine. It involves several tests to detect and measure various compounds that pass through the urine.

Urinary incontinence – involuntary urination or leakage of urine.

Urinary tract – a continuous anatomical tract, including the kidneys, ureters, and urethra, involved in the formation and excretion of urine.

Urine – is a typically sterile liquid by-product of the body secreted by the kidneys through a process called urination and excreted through the urethra.

Urostomy – is an artificial opening for the urinary system. A urostomy is made to avail for urinary diversion in cases where drainage of urine through the bladder and urethra is not possible, e.g. after extensive surgery or in case of obstruction.

Uterine (endometrial) cancer – cancer that originates in the tissue of the uterus.

Uterus – is a hollow muscular organ located in the female pelvis between the bladder and rectum. The ovaries produce the eggs that travel through the fallopian tubes. Once the egg has left the ovary it can be fertilized and implant itself in the lining of the uterus. The main function of the uterus is to nourish the developing fetus prior to birth.

Uvula – a small, conical, fleshy mass of tissue suspended from the center of the soft palate.

Vagina – is the female body part that connects the womb (uterus) and cervix to the outside of the body. The vagina is a muscular tube lined with mucus membranes. Its opening is between the urethra (where urine exits the body) and the anus. The vagina allows for the flow of menstrual blood and for sexual intercourse, and is the passageway through which a baby is born

Vaginal – having to do with the vagina.

Vaginal cancer – cancer originating in the tissue of the vagina.

Valvular heart disease – is characterized by damage to or a defect in one of the four valves of the heart: the aortic valve, the mitral valve, the tricuspid valve or the pulmonic valve. In valvular heart disease, the valves become too narrow and hardened (stenotic) to open fully or are unable to close completely (incompetent). A stenotic valve forces blood to back up in the adjacent heart chamber, while an incompetent valve allows blood to leak back into the chamber it previously exited.

Vas deferens – the main duct through which semen is carried from the epididymis to the ejaculatory duct.

Vasospastic disorder (Raynaud's phenomenon) - causes discoloration of the fingers, and toes. It is an exaggeration of vasomotor responses to cold or emotional stress.

Ventral – opposite of dorsal. A position on or towards the front of the body.

Vertebral column - is a series of approximately 33 bones called vertebrae, which are separated by intervertebral discs. The column can be divided into five different regions, with each region characterized by a different vertebral structure.

Vertigo - is a symptom, rather than a condition itself. It's the sensation that you, or the environment around you, is moving or spinning.

Vesicoureteral reflux (VUR) - is a condition in which urine flows retrograde, or backward, from the bladder into the ureters/kidneys.

Visceral metastases – areas of cancer spread, to the liver, lungs, or other organs in the body.

Vitiligo - is a long-term skin condition characterized by patches of the skin losing their pigment. The patches of skin affected become white and usually have sharp margins. The hair from the skin may also become white. The inside of the mouth and nose may also be involved.

Vocal cord – are two bands of elastic muscle tissue. They are located side by side in the voice box (larynx) just above the windpipe (trachea). Like other tissues in the body, vocal cords can be strained and damaged.

Vocal cord stripping – is when the doctor uses a long surgical instrument to strip away the superficial layers of tissue on the vocal cords. This can be done to biopsy and treat some stage 0 cancers (carcinoma in situ) of the vocal cords. Most people can speak normally again after recovering from this operation.

Voice box (larynx) – the part of the respiratory tract between the pharynx and the trachea, having walls of cartilage and muscle and containing the vocal cords enveloped in folds of mucous membrane.

Volitional fatigue – better known as momentary muscle failure or the point at which you can't do another repetition without "cheating."

Vomit – to eject part or all of the contents of the stomach through the mouth, usually in a series of involuntary spasmic movements. The act or an instance of ejecting matter from the stomach through the mouth.

Votrient® (Pazopanib) – also blocks several tyrosine kinases. These kinases are involved in cancer cell growth and the formation of new blood vessels. It is taken as a pill once a day.

Wedge resection – a surgical procedure to remove a triangle-shaped slice of tissue. It may be used to remove a tumor or some other type of tissue that requires removal and typically includes a small amount of normal tissue around it. It is easy to repair, does not greatly distort the shape of the underlying organ and leaves just a single stitch line as a residual.

Whipple procedure (pancreatoduodenectomy) – a type of surgery used to treat pancreatic cancer. This operation is performed to treat cancerous tumors on the head of the pancreas, or those involving the common bile duct, and the duodenum.

White blood cell (leukocyte) – a type of immune cell made in the bone marrow and found in the blood and lymphatic tissue. Leukocytes help the body fight infections and other diseases.

Wide surgical excision – surgery to remove the cancer and a margin of normal tissue extending to 2-3 centimeters in all directions from the tumor site. This procedure usually takes away a significant amount of muscle and may involve resecting nerves that can affect function and leave areas of numbness.

Windpipe (trachea) – is a tube that connects the pharynx and larynx to the lungs, allowing the passage of air.

X-ray – a type of electromagnetic radiation, just like visible light. An x-ray machine sends individual x-ray particles through the body. The images are recorded on a computer or film. Structures that are dense (such as bone) will block most of the x-ray particles and will appear white. Metal and contrast media (special dye used to highlight areas of the body) will also appear white. Structures containing air will be black, and muscle, fat, and fluid will appear as shades of gray.

Xgeva® (Denosumab) – is a new medication that blocks a molecule involved in the formation of bone abnormalities caused by prostate cancer. It has recently been approved by the FDA for preventing bone complications related to metastatic disease.

Xeropthalmia - abnormal dryness of the conjunctiva and cornea of the eye, with inflammation and ridge formation, typically associated with vitamin A deficiency.

Xerostomia - is defined as dry mouth resulting from reduced or absent saliva flow.

Wilm's tumor – is a pediatric form of kidney cancer and is very rare among adults.

Yolk sac carcinomas – is the most common form of testicular cancer in children. These tumors are usually treated successfully in children, but when they develop in adults, it is a bigger concern. Yolk sac carcinomas respond very well to chemotherapy, even when they have metastasized.

Zoledronic acid (Zometa) – is the current standard of care for men with metastatic prostate cancer. It helps to prevent bone pain and fractures in men with metastatic prostate cancer.

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