ANATOMY & PHYSIOLOGY FOUNDATIONS

PRESENTATION PACK

Bundle Rev.
3.0

PRESENTATION PACK CONTENTS

1. NERVOUS SYSTEM ANATOMY

- Gain an understanding of the foundational anatomy and physiology of the nervous system.
- Become familiar with the significance of vagal tone in the experience of stress and the effectiveness of yoga techniques.
- Understand the functioning of the sympathetic and parasympathetic nervous systems, and the workings of the Stress Response, Fight or Flight Response and Relaxation Response.

2. YOGA FOR STRESS REDUCTION

- Become proficient in communicating how yoga practices impact the nervous system and why this is a critical factor in the positive results from yoga practice.

3. RESPIRATORY ANATOMY

- Gain an understanding of the foundational physiology of the respiratory system.
- Become familiar with the nasal cycle and lungs; the differentiation between primary and accessory respiratory muscles; and the muscles used for inspiration and for expiration.

CONTENTS, CONTINUED

4. SPINAL ANATOMY

- Become proficient in the anatomy of the spine including each of the five regions, the spinal curves and the vertebrae.
- Learn the functions of the spine and the attributes of a healthy spine.

5. CORE ANATOMY

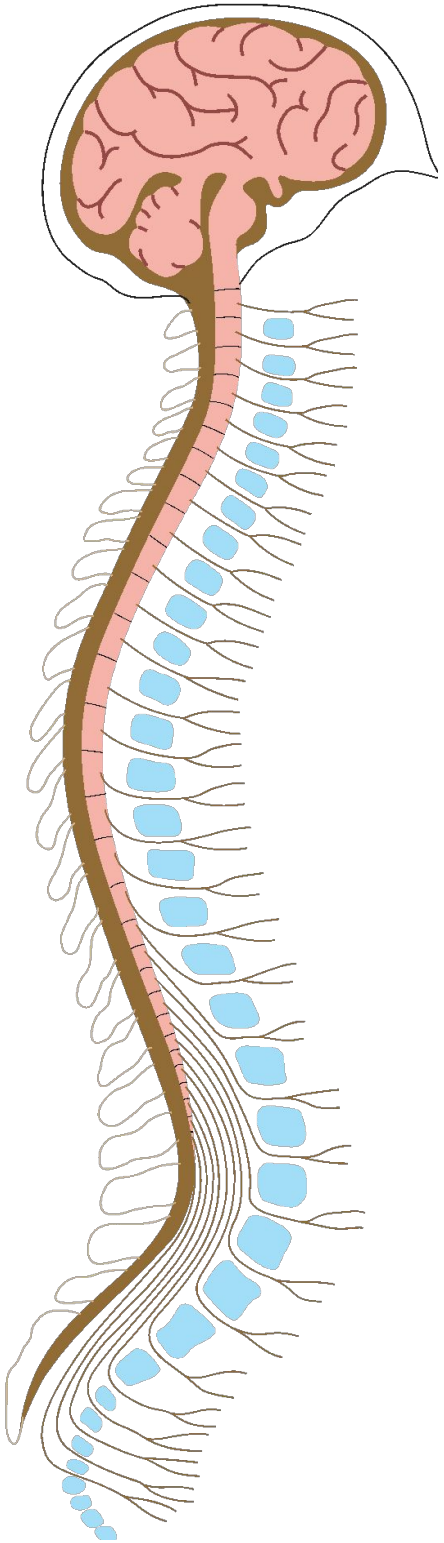
- Gain an understanding of the foundational anatomy of the core, including the function of the individual muscles and the core as a whole.
- Become more deeply knowledgeable about the TA and how to effectively teach engagement of the deeper abdominals.

NERVOUS SYSTEM

A NETWORK OF INTELLIGENT ENERGY

By communicating through your nerves, your nervous system constantly monitors the internal activities of your body systems, attempting to keep them in a healthy balance called "homeostasis." It also monitors your environment to assess if it is safe or dangerous, and sends messages to your body, either to relax and enjoy, or act quickly to get to safety.

– Yoga for Healthy Aging



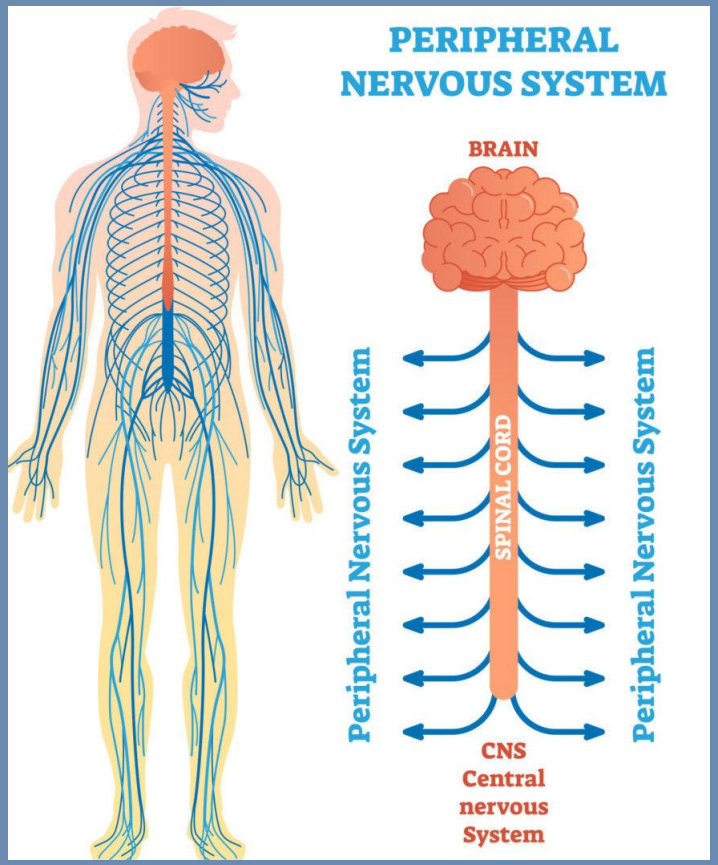
Highlights

- LEARNING OBJECTIVES
- FORM & FUNCTION
- CNS, PNS, VAGUS NERVE
- ENTERIC NERVOUS SYSTEM

Version 3.5

LEARNING OBJECTIVES

- Gain an understanding of the foundational anatomy and physiology of the nervous system.
- Become familiar with the significance of vagal tone in the experience of stress and the effectiveness of yoga techniques.
- Understand the functioning of the sympathetic and parasympathetic nervous systems, and the workings of the Stress Response, Fight or Flight Response and Relaxation Response.



The human brain contains about 100 billion neurons… The brain is made up of many networks of communicating neurons. In this way, different parts of the brain can “talk” to each other as well as work together to send messages to the rest of the body.

— National Institutes of Health

FORM

- The nervous system consists of the brain, spinal cord, neurons, nerves, meninges, cerebrospinal fluid and sensory receptors.
- The nervous system is divided into the central nervous system and peripheral nervous system.
- The central nervous system (CNS) is comprised of the brain and spinal cord.
- The peripheral nervous system contains all the nerves that lie outside of the spinal cord and brain.
- The nervous system includes a collection of nerves and neurons that transmit signals between different parts of the body. "It is essentially the body's electrical wiring." (livescience)
- The “basic working unit” of the nervous system is a cell called a neuron.
- Neurons communicate via electrical signals which are converted into chemical messengers called

FUNCTION

The nervous system:

- Regulates certain body processes such as blood pressure and breathing rate, and
- Connects the brain and spinal cord with muscles and sensory receptors.

The functions of the nervous system can be categorized as having 3 types: sensory, integration and motor. (InnerBody)

SENSORY FUNCTION

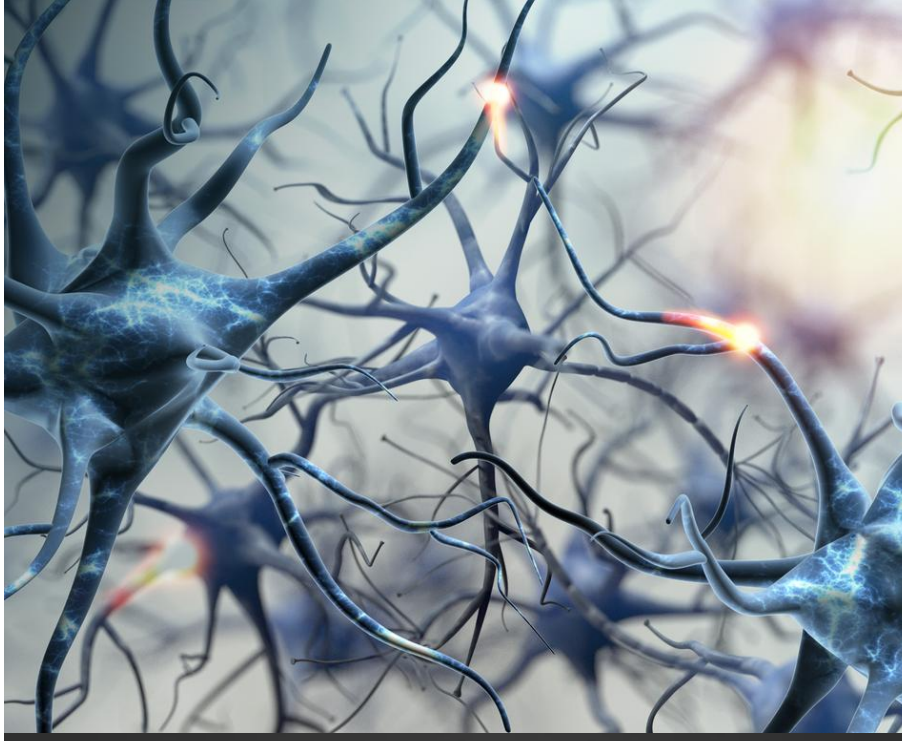
Involves collecting information and passing it on to the central nervous system.

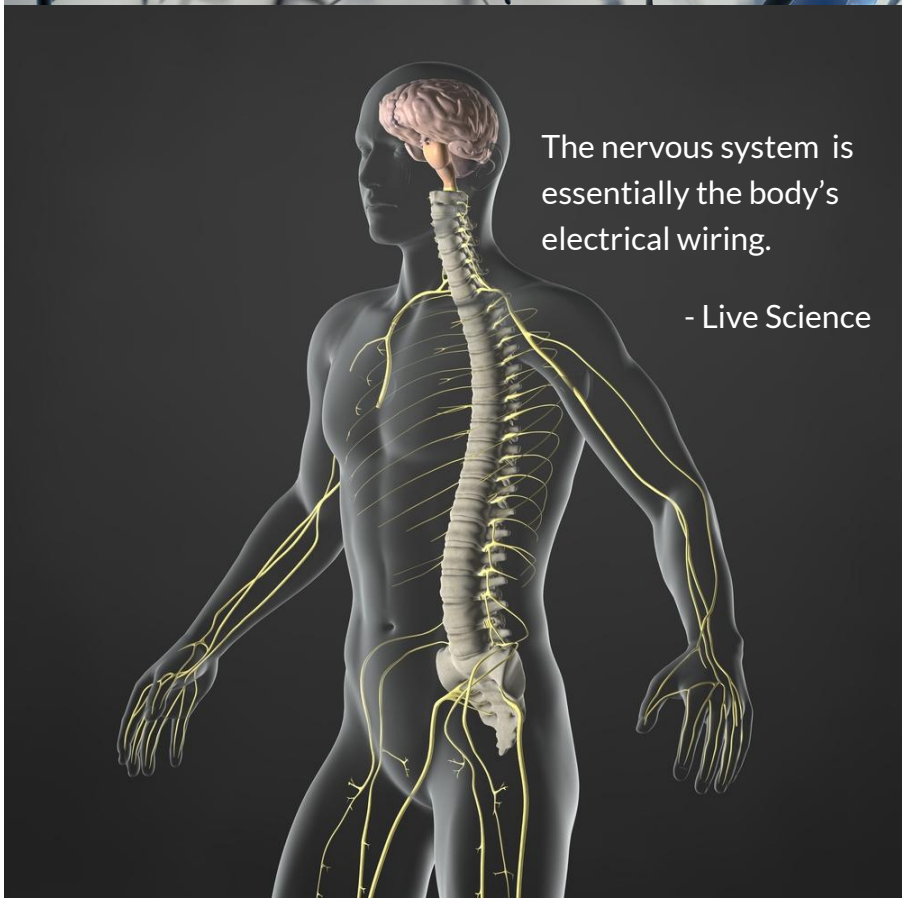
INTEGRATION

Refers to an evaluation of the signals by the brain and spinal cord.

MOTOR FUNCTION

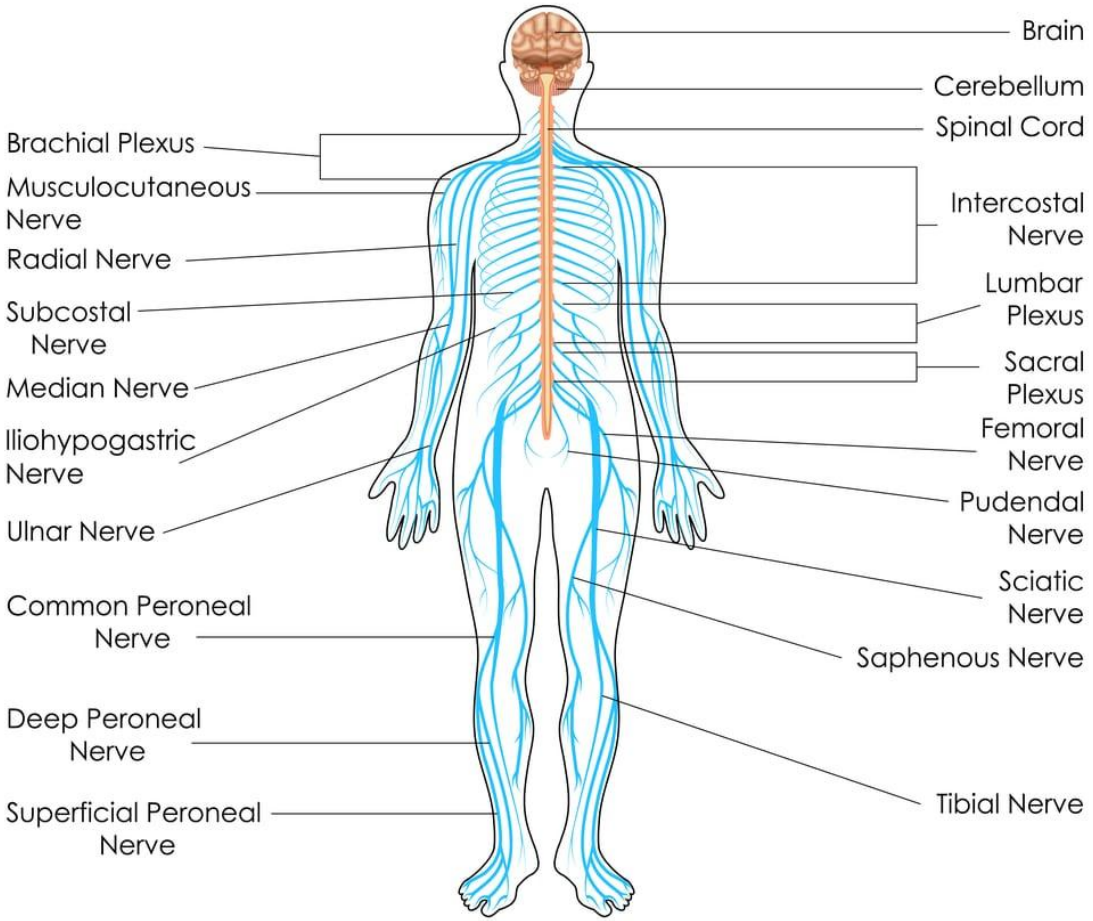
The carrying of signals from the CNS that can result in, for instance, moving a part of the body.





- The central nervous system (CNS) is defined as the brain and spinal cord.
- The peripheral nervous system (PNS) includes all the other parts of the nervous system which communicate between the CNS and the rest of the body.
- The PNS contains 12 cranial nerves and 31 pairs of spinal nerves and ganglia.
- The PNS is divided into the somatic (voluntary) and autonomic (typically involuntary) nervous systems.
- The somatic nervous system controls conscious bodily activities such as moving the arm.
- The autonomic nervous system (ANS) governs the typically automatic functions including breathing, heart rate and the endocrine (hormone) system.

PERIPHERAL NERVOUS SYSTEM (PNS)



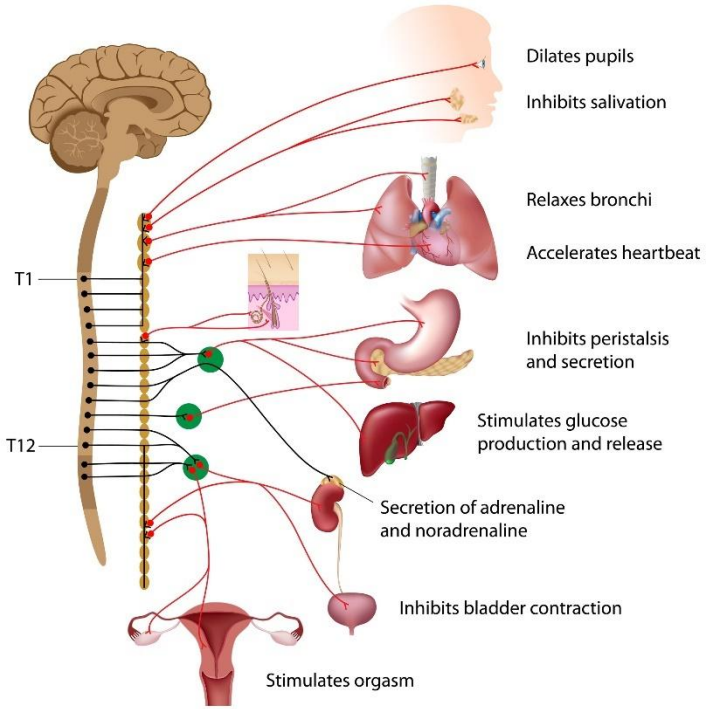
AUTONOMIC NERVOUS SYSTEM (ANS)

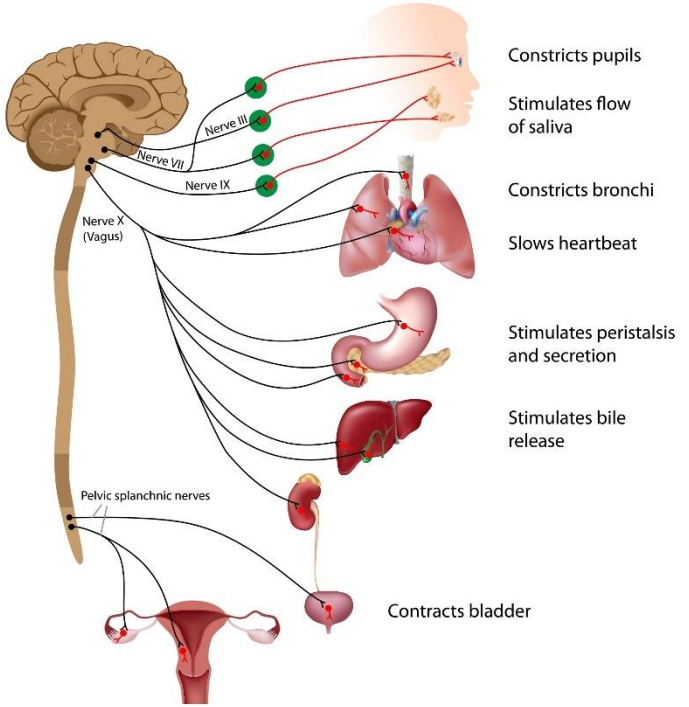
- The Autonomic Nervous System (ANS) is an area of particular focus for understanding how yoga practices reduce negative effects of chronic stress and improve health and wellness.

- The ANS is divided into the sympathetic and parasympathetic nervous systems, only one of which is activated at any time.

SYMPATHETIC NERVOUS SYSTEM

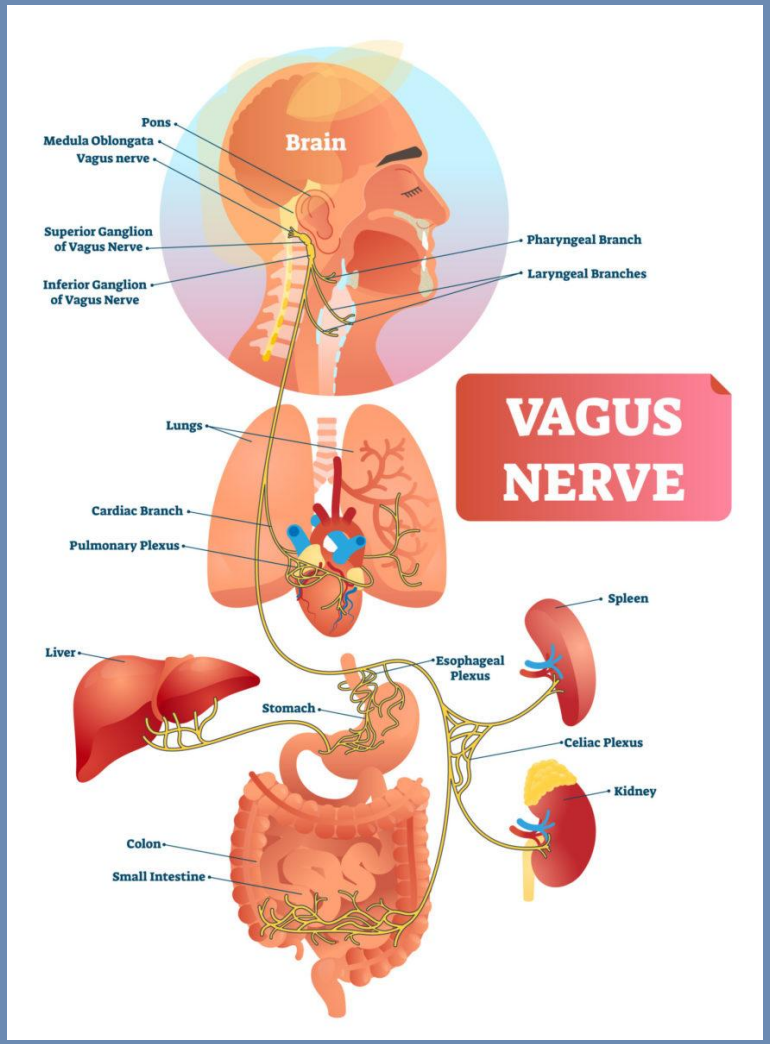
The sympathetic nervous system triggers the stress response. When stress is perceived to be excessive or threatening, a physiological reaction called the Fight or Flight Response occurs.





PARASYMPATHETIC NERVOUS SYSTEM

The parasympathetic nervous system controls the Relaxation Response and the Rest and Digest state (which indicates full parasympathetic activation when the body's vital signs are in their calm state, and the immune, repair, and digestive systems are operating).



At last, science is catching up with what yogis and other mystic and healing traditions around the world have known for thousands of years.

— Edwina Shaw

THE VAGUS NERVE

- An element of the parasympathetic nervous system, the vagus nerve is one of 12 pairs of cranial nerves that originate in the brain.
- It is the largest and most complex nerve in the body.
- From the brain, it passes through the neck, spreading nerve fibers through the body.
- "Vagus" means "wandering" in Latin and the vagus nerve is also known as the "wandering nerve" because from its two origination points in the brain, it branches out to the "lowest viscera of the abdomen, touching your heart and most major organs along the way." (Christopher Bergland)
- It has been called the "air traffic controller" because it helps, among other things, to regulate major bodily functions., influencing the lungs, heart, stomach and intestines.
- The vagus nerve both sends and receives signals between the brain and visceral organs. It sends sensory information about the state of the body's organs to the brain. And, in a mind-body feedback loop, messages also travel to the organs, signaling if there is an inner calm or if there is danger. (Christopehr Bergland)
- The vagus nerve is activated by stimulating the vocal cords through such instinctive actions as groaning when in pain and moaning during childbirth. Regular practice of *pranayama*, chanting, singing, lovingkindness meditation and other practices may raise vagal tone, boost the immune system and contribute to feelings of well-being.

ENTERIC NERVOUS SYSTEM

- The Enteric Nervous System (ENS) is a system of nerves located in the abdomen.
- The ENS communicates with the brain and can act independently of it.
- It is often referred to as the "second brain."
- Ninety percent of serotonin (the neurotransmitter responsible for feelings of happiness and well-being) is produced in the second brain.

THE "SECOND BRAIN"

The ENS can work all on its own, without any input from the brain… The newest mind-body connection to be revealed — and sometimes considered a branch of the autonomic nervous system — it does much more than control itself. It also sends signals north to the brain that directly affect feelings of sadness or stress, even influence memory, learning, and decision-making.

– Psychology Today

END
NERVOUS SYSTEM

YOGA FOR STRESS REDUCTION

An agitated nervous system fails to receive the Spirit's guidance, just as a warped antenna cannot receive television signals properly. The nervous system feels joy and sorrow, initiates laughter and tears. However, when under stress, it fumbles through its job, and so do we. In our yoga practice and in life, we must protect our nervous system and ensure that it lives in a state of equanimity.

– Aadil Palkhivala

Highlights

- LEARNING OBJECTIVE
- RELAXATION RESPONSE
- VAGUS NERVE
- YOGA FOR STRESS RELIEF
- SUMMARY

Version
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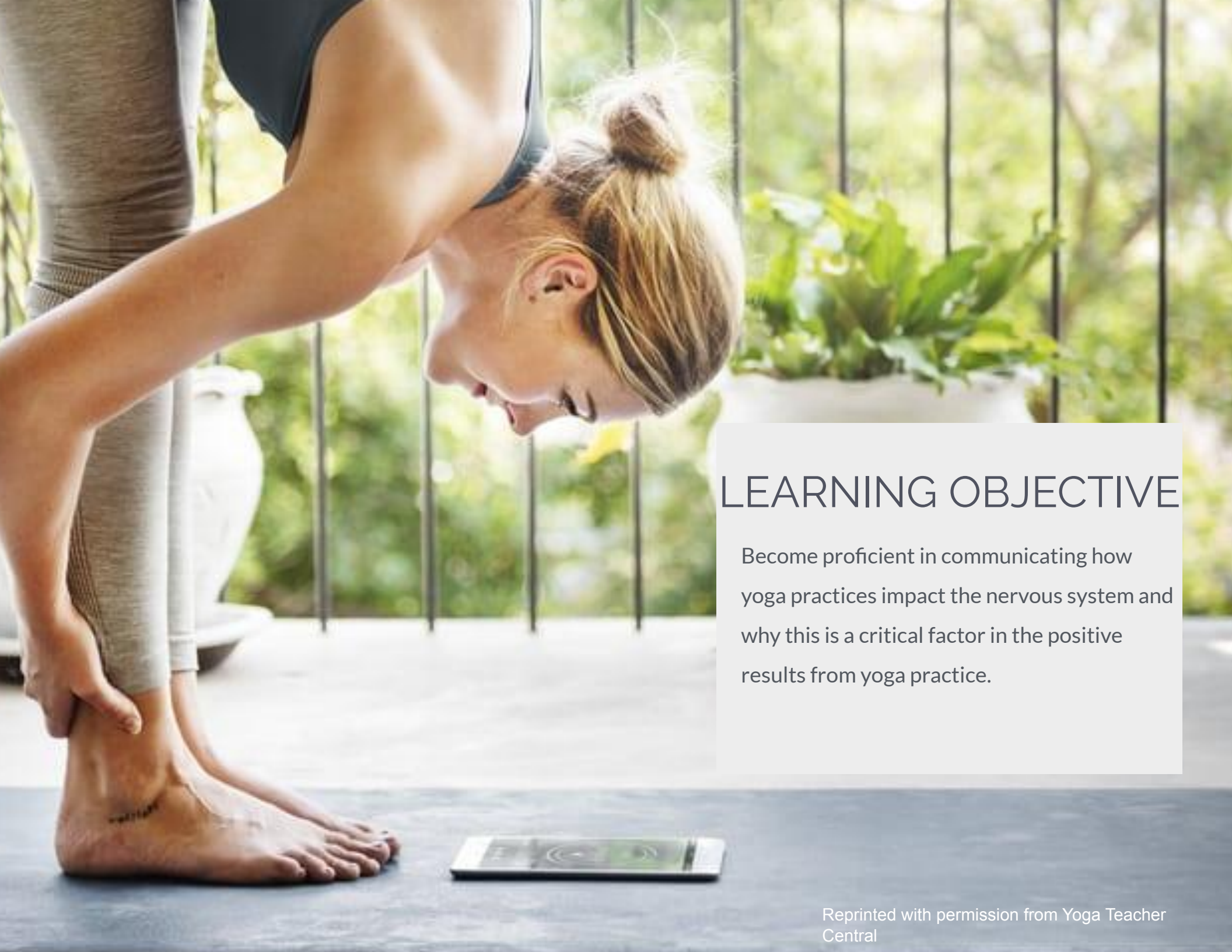


LEARNING OBJECTIVE

Become proficient in communicating how yoga practices impact the nervous system and why this is a critical factor in the positive results from yoga practice.

RELAXATION RESPONSE

Dr. Herbert Benson, M.D. published research in 1975 documenting what he termed the Relaxation Response, " a physical state of deep rest that changes the physical and emotional response to stress… the opposite of the fight or flight response."

- Initiating the relaxation response switches off the stress response and its associated increase in heart rate, blood pressure, mental alertness and muscle tension.
- When the relaxation response is activated, so too are the bodily systems that were shut down from the sympathetic nervous system activation, including digestion, elimination, growth, repair and reproduction.
- Meditation and relaxation exercises have been shown to initiate the Relaxation Response and often the positive effects of yoga are a result of affecting the nervous system in this way.

THE IMPACT OF THE BREATH ON STRESS

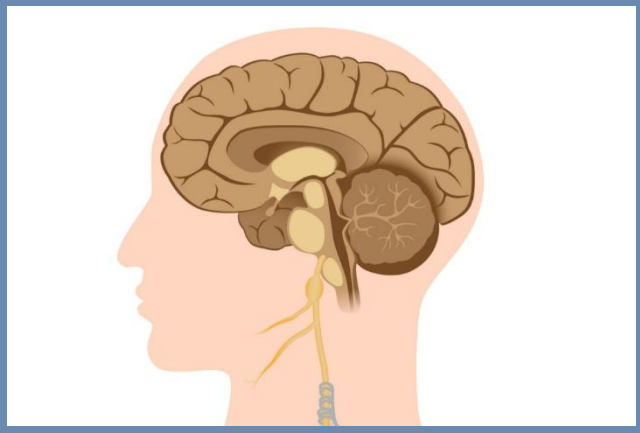
In stressful times, we typically breathe too rapidly. This leads to a buildup of oxygen in the bloodstream and a corresponding decrease in the relative amount of carbon dioxide, which in turn upsets the ideal acid-alkaline balance — the pH level — of the blood. This condition, known as respiratory alkalosis, can result in muscle twitching, nausea, irritability, lightheadedness, confusion, and anxiety. In contrast, slowing the breath raises the carbon dioxide level in the blood, which nudges the pH level back to a less alkaline state. As the blood's pH changes, the parasympathetic nervous system calms us in a variety of ways.

– Richard Rosen

THE VAGUS NERVE

Since the vagus nerve innervates the chest, any kind of practices or activities that influence the energy flow through the vagus nerve will have a profound effect on respiration and circulation.

– Dr. Ram Rao



- We cannot directly and consciously stimulate the vagus nerve. Rather, it is stimulated indirectly by activities that induce the Relaxation Response.
- Study results from Boston University led researchers to hypothesize that yoga works by increasing vagal tone and thereby regulating the nervous system.
- *Ujjayi Pranayama* was shown to increase the relaxation response and heart rate variability (a function of stress resilience).
- Chanting Om out loud increased vagal tone and the relaxation response more than chanting it silently.

YOGA FOR STRESS RELIEF

DIAPHRAGMATIC BREATHING ACTIVATES RELAXATION RESPONSE

Diaphragmatic breathing activates the relax-and-digest response by stimulating the primary mediator of the parasympathetic nervous system, the vagus nerve. This nerve travels from the brain to nearly all the thoracic and abdominal organs… and triggers a cascade of calming effects… As long as you are breathing deeply and from the diaphragm, you will find that you can access a feeling of calm and balance even when you are confronted with an unpleasant situation. And you will also notice that if you allow your breath to become shallow by breathing from your chest, anxiety creeps in, your muscles tighten, and your mind begins to race and spin.

– Carrie Demers, MD, Himalayan Institute

HOW DOES YOGA RELIEVE STRESS?

YOGA RELIEVES STRESS IN VARIOUS WAYS

- Calming breathing practices, conscious relaxation and some mindfully-practiced *asana* (including inversions) can trigger the Relaxation Response.
- Yoga practices indirectly stimulate the vagus nerve and help to sustain vagal tone, encouraging a healthy shift from the Fight or Flight Response to the Relaxation Response.
- Stress causes a rapid breath rate and yoga can slow the breath down.
- Slower, diaphragmatic breathing helps to balance the pH level of the blood.
- Releasing tension in the psoas is related to relieving stress.
- The Stress Response includes not only such activities as increased heart rate, but also particular muscular contractions. Yoga practices help to release muscular tension induced by the Stress Response.

WORDS OF WISDOM

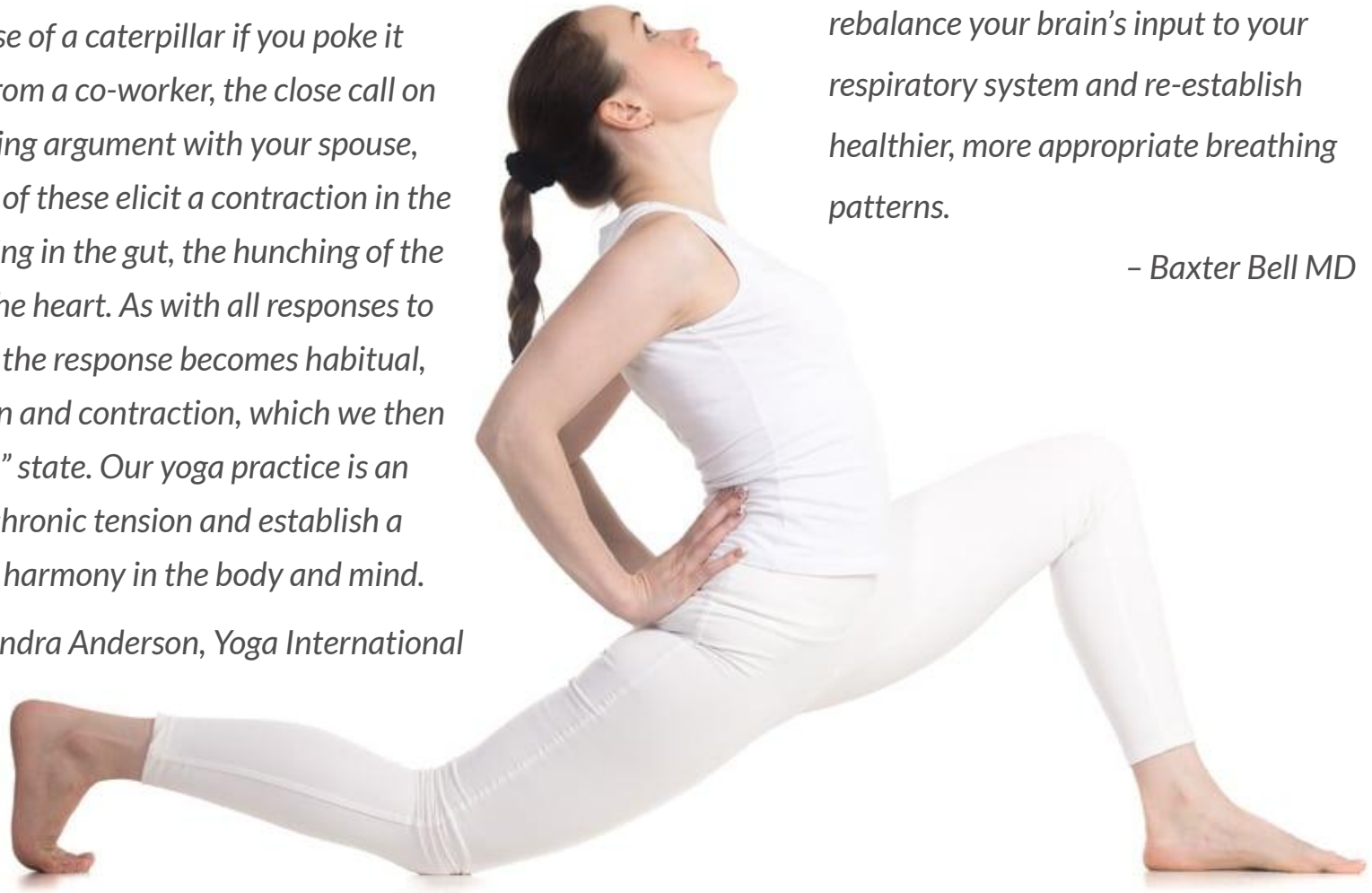
UNDOING THE STRESS RESPONSE IN FLEXORS

Part of the stress response hardwired into our nervous system is the contraction of the major flexors of the torso — somewhat like the response of a caterpillar if you poke it with a twig. A verbal jab from a co-worker, the close call on the freeway, a long- standing argument with your spouse, free-floating anxiety — all of these elicit a contraction in the flexors. This is the tightening in the gut, the hunching of the shoulders, the sinking of the heart. As with all responses to stress, the problem is that the response becomes habitual, resulting in chronic tension and contraction, which we then experience as our "normal" state. Our yoga practice is an opportunity to undo this chronic tension and establish a deep and abiding sense of harmony in the body and mind.

– Sandra Anderson, Yoga International

By using yoga stress management techniques and spending more time in a state of relaxation, you can rebalance your brain's input to your respiratory system and re-establish healthier, more appropriate breathing patterns.

– Baxter Bell MD

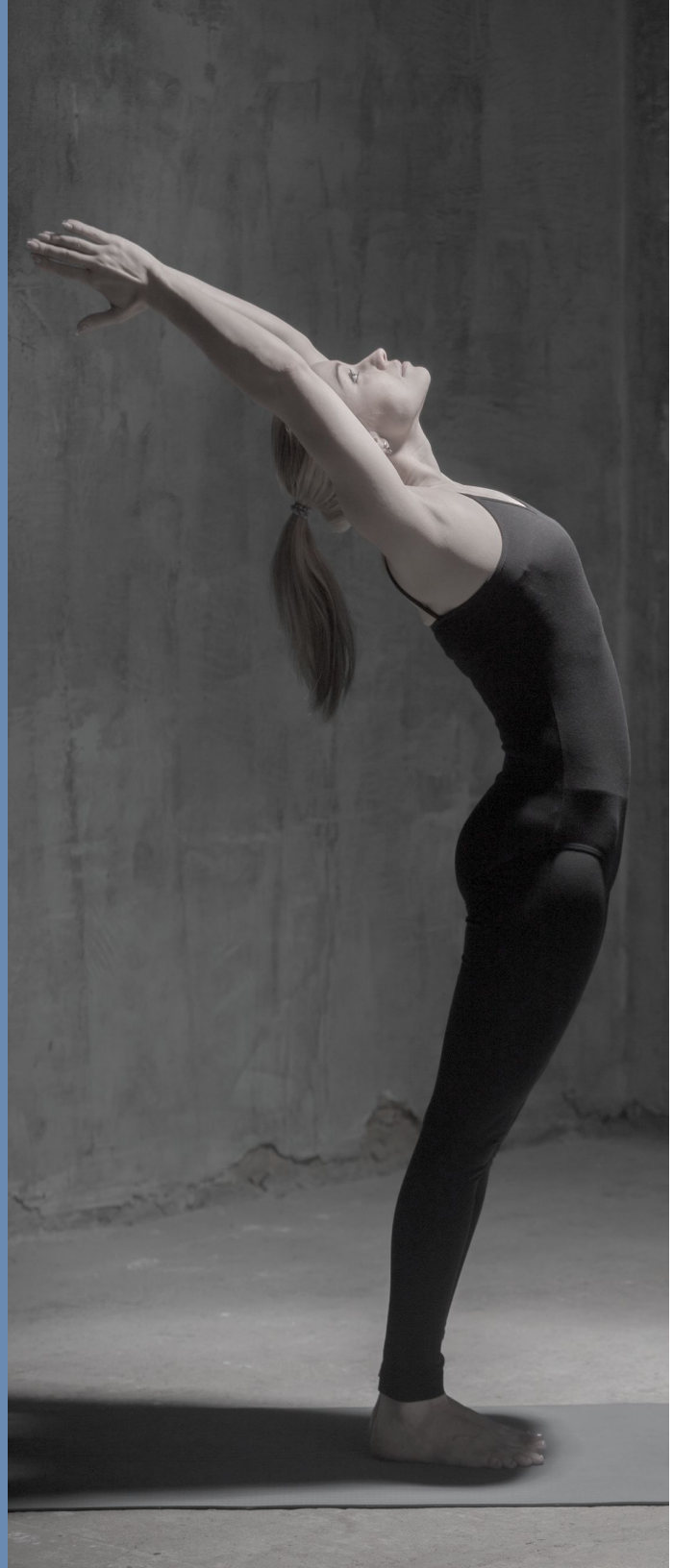


END
YOGA FOR STRESS REDUCTION

Highlights

- LEARNING OBJECTIVES
- BREATHING DEFINED
- THE DIAPHRAGM
- IS THERE A RIGHT WAY TO BREATHE?
- ACCESSORY MUSCLES

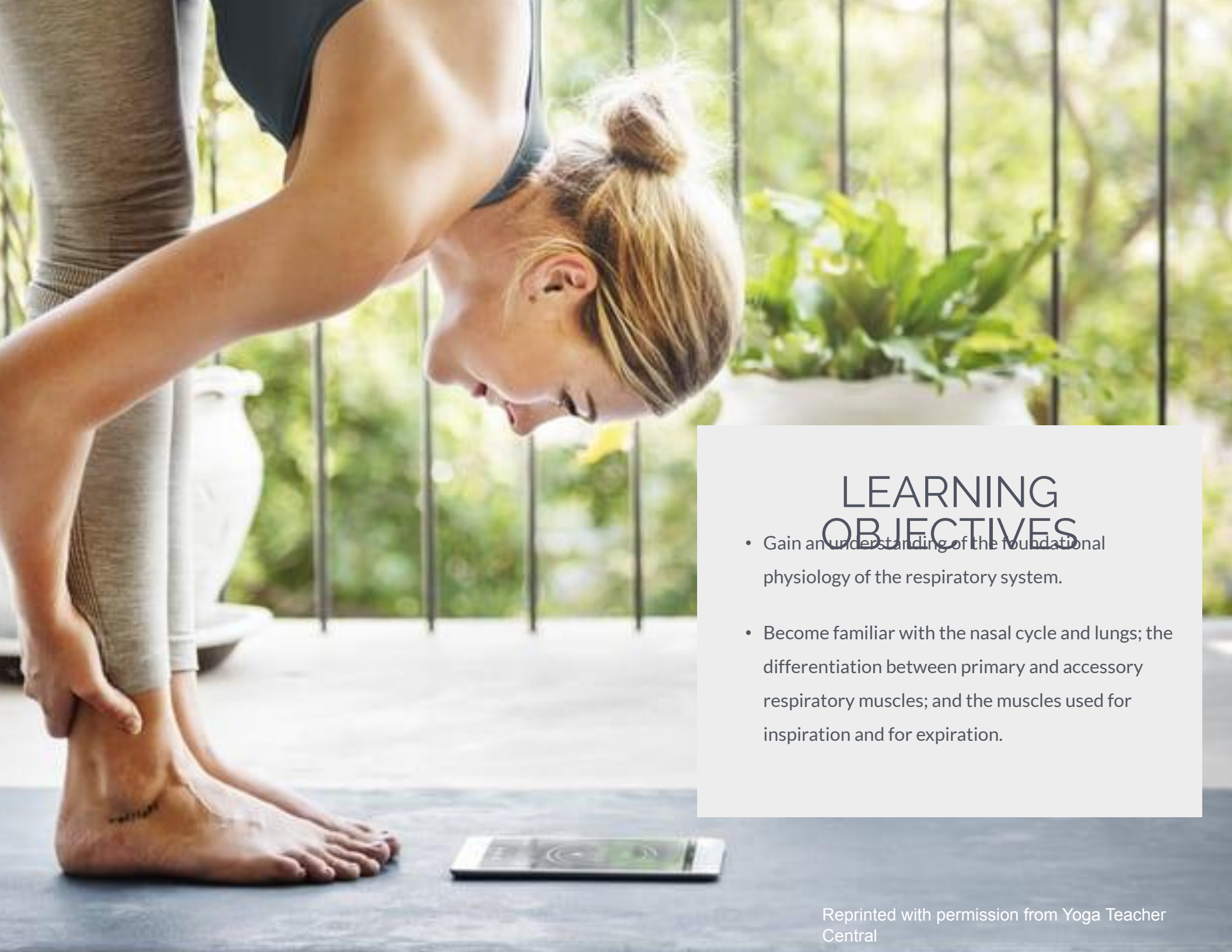
Version 3.8



RESPIRATORY ANATOMY

Respiration is essential for sustaining all forms of animal life — from the single-celled amoeba to man. It is possible to live without food or water for a few days, but when respiration ceases, so does life... Breathing starts with independent life outside the mother and ends when life ceases.

— B.K.S. Iyengar



LEARNING OBJECTIVES

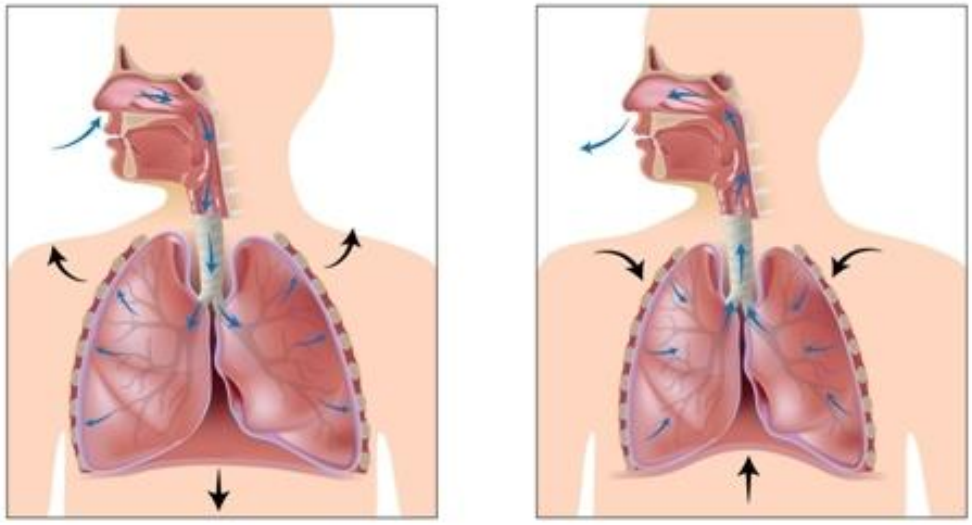
- Gain an understanding of the foundational physiology of the respiratory system.
- Become familiar with the nasal cycle and lungs; the differentiation between primary and accessory respiratory muscles; and the muscles used for inspiration and for expiration.

INTERFACE BETWEEN TWO LEVELS

Breathing occurs on the level of the internal organs, just like the beating of the heart; but in contrast to the heart, it also involves muscles, certain parts of the skeleton and joint articulations. It cannot be separated from these. Breathing thus becomes an interface between two levels: the level of the organs and the level of movement. It can therefore be controlled, albeit with limitations, by the nervous systems' management of either one of these two levels.

– Blandine Calais-Germain

BREATHING DEFINED

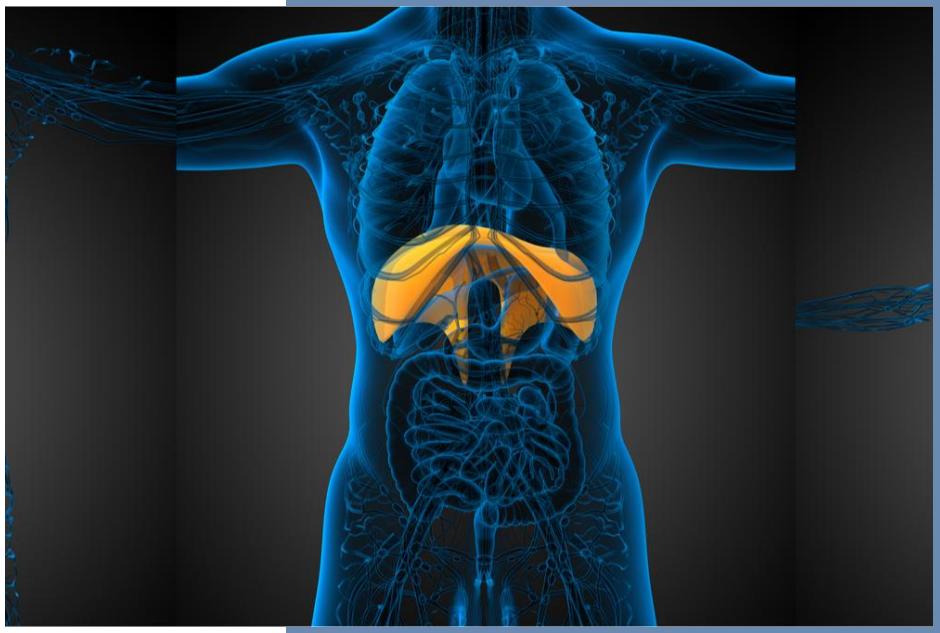


Inspiration

Expiration

- Breathing is the movement of air into and out of the lungs.
- The primary purpose of breathing is to supply fresh oxygen to the blood and cells, and to discharge carbon dioxide.
- Respiration is the act of breathing.
- Breathing is defined as the “physical and chemical processes by which oxygen is conveyed to tissues and cells, and the oxidation products, carbon dioxide and water, are given off.” (dictionary.com)

THORACIC & ABDOMINAL CAVITIES



OVERVIEW

The torso is divided into the thoracic and abdominal cavities, which change shape during breathing.

- The thoracic cavity contains the heart and lungs.
- The abdominal cavity contains the stomach, liver, gall bladder, spleen, pancreas, small and large intestines, kidneys, and bladder.

THORACIC CAVITY

- When breathing, the thoracic cavity changes shape and volume.
- Respiratory muscles increase the dimension of the thoracic cavity, lowering air pressure in the lungs (i.e. creating a vacuum) to facilitate the receiving of air.
- When the muscles relax and the diaphragm billows back up, the air in the chest is compressed, allowing it to move out.

ABDOMINAL CAVITY

- During breathing, the abdominal cavity changes shape but not volume.
- When speaking of abdominal changes during normal breathing, anatomy experts use terms such as "bulge," "swell" or "puff out." This is because the belly is not actually "expanding."

The abdominal cavity changes shape like a... water balloon. When you squeeze one end of a water balloon, the other end bulges... Your hand's action only moves the fixed volume of water from one end of the flexible container to the other... In the context of breathing the abdominal cavity changes shape, but not volume. (In life processes other than breathing... the abdominal cavity does change volume.) In contrast to the abdominal cavity, the thoracic cavity changes both shape and volume; it behaves... similar to an accordion

THE DIAPHRAGM

- Like the heart, the diaphragm works without break.
- The pericardium which surrounds the heart is connected via fascia to the diaphragm. Therefore, the heart moves along with the diaphragm during breathing.
- When the diaphragm moves fully with the breath, Donna Farhi notes that nearby organs are "massaged, rolled, churned, and bathed in new blood, fluids, and oxygen." These organs that move with the diaphragm include the heart, lungs, stomach, pancreas, gallbladder, small intestine, liver and spleen.

INTRODUCTION

- The diaphragm is a dome-shaped muscle located at the base of the lungs. It separates the thoracic and abdominal cavities.
- The diaphragm is a muscle. As with other muscles, the diaphragm can become tight or weak.
- Lungs do not have muscular tissue and therefore, cannot be moved directly at will; the diaphragm is the principal muscle involved in breathing.
- The diaphragm acts as a pump causing the lungs to inflate.
- During relaxed breathing, on the in-breath, the diaphragm contracts (moves down) to give the lungs more room to fill up. The abdominal organs are compressed, and the abdomen typically puffs out.
- On the out-breath, the diaphragm relaxes, and moves back up; the belly typically moves back in.

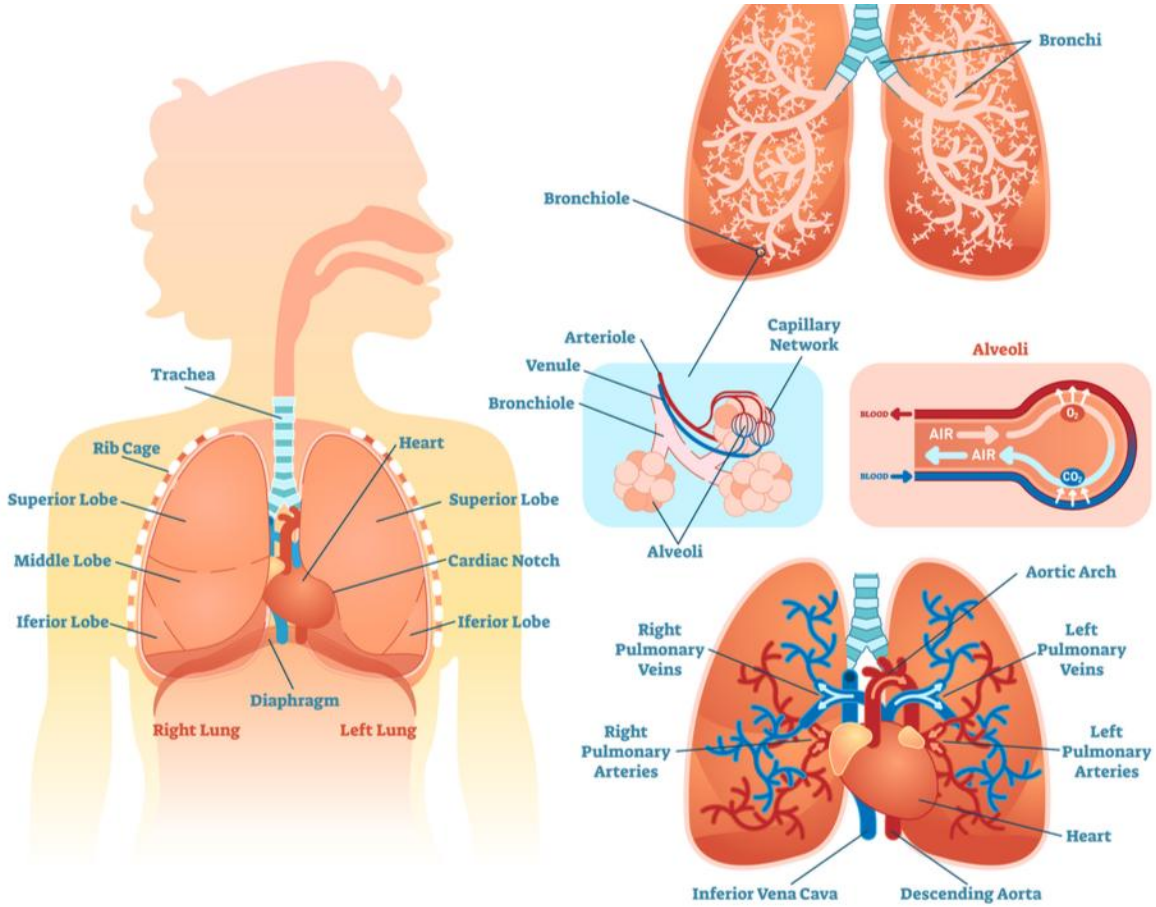
ISSUES

If you are relatively active and healthy, the diaphragm does not need any special "exercising." However, if you have been sedentary, suddenly gained weight, suffered from periods of inactivity or developed poor posture, your diaphragm may not be working optimally. In these cases, you can use your asana practice to stretch areas of restriction and re-establish healthy posture. And you can use breathing practices, such as gradually lengthening your inhalation and exhalation, to improve your lung capacity over time.

– Baxter Bell MD

- When the abdomen is chronically tightened, the diaphragm is unable to move downward and secondary muscles are recruited.
- Using the secondary muscles (designed for short-term use) for regular deep breathing is tiring and ineffective.
- If the diaphragm is tight, weak, or unable to move freely, it can affect stress level, circulation, emotions, digestion and spinal stability. (Yoga Tune Up)

THE LUNGS



- Lungs have five lobes: three in the right lung (upper, middle and lower lobes) and two in the left (upper and lower lobes).

- Because lungs are pear-shaped, the fill capacity of the upper lungs is less than the lower.

- With a full inhalation, air reaches the lower lungs where, according to one source, there is more blood available for oxygen exchange. (source: Mukunda Stiles quoting John Douillard)

THE NOSE

The nasal cycle refers to how humans and other animals breathe in patterns, alternating their breathing through one nostril and then the other.

- Tubes in the nose moisten air from the in-breath and fine hairs filter the air.
- Due to the relationship between a nose's form and its function, people in different climates show a different nose structure.
- The right nostril corresponds to the left side of the brain (which governs thinking, intellect, and reason), and is connected to the sympathetic nervous system.
- The left nostril corresponds to the right side of the brain (responsible for feelings and intuition) and triggers the parasympathetic nervous system.
- See also: *Nadi Shodhana Pranayama*.

BREATHING THROUGH THE NOSE OR THE MOUTH

Both ways of breathing — through the nose and through the mouth — are possible, and each has its advantages and disadvantages. When you breathe through the nose, the air is warmed up and humidified; cleaned of dust particles; and cleaned of bacteria. Thus, the air that reaches the lungs is warm, purified, and of good quality. From this point of view, it is better to breathe through the nose... [However,] it's easier to do deeper breathing through the mouth... When inhaling or exhaling through the mouth, you can also vary the airflow more easily than when you breathe through the nose.

– Blandine Calais-Germain

IS THERE A "RIGHT" WAY TO BREATHE?

Ancient yogis detected what scientists now refer to as the nasal cycle. Humans (and other animals) cycle alternately from breathing through one nostril to breathing through the other, for periods ranging from a few minutes to a few hours. This pattern continues even during sleep... More and more scientific research is supporting the notion that breathing through different nostrils has very different effects on the body.

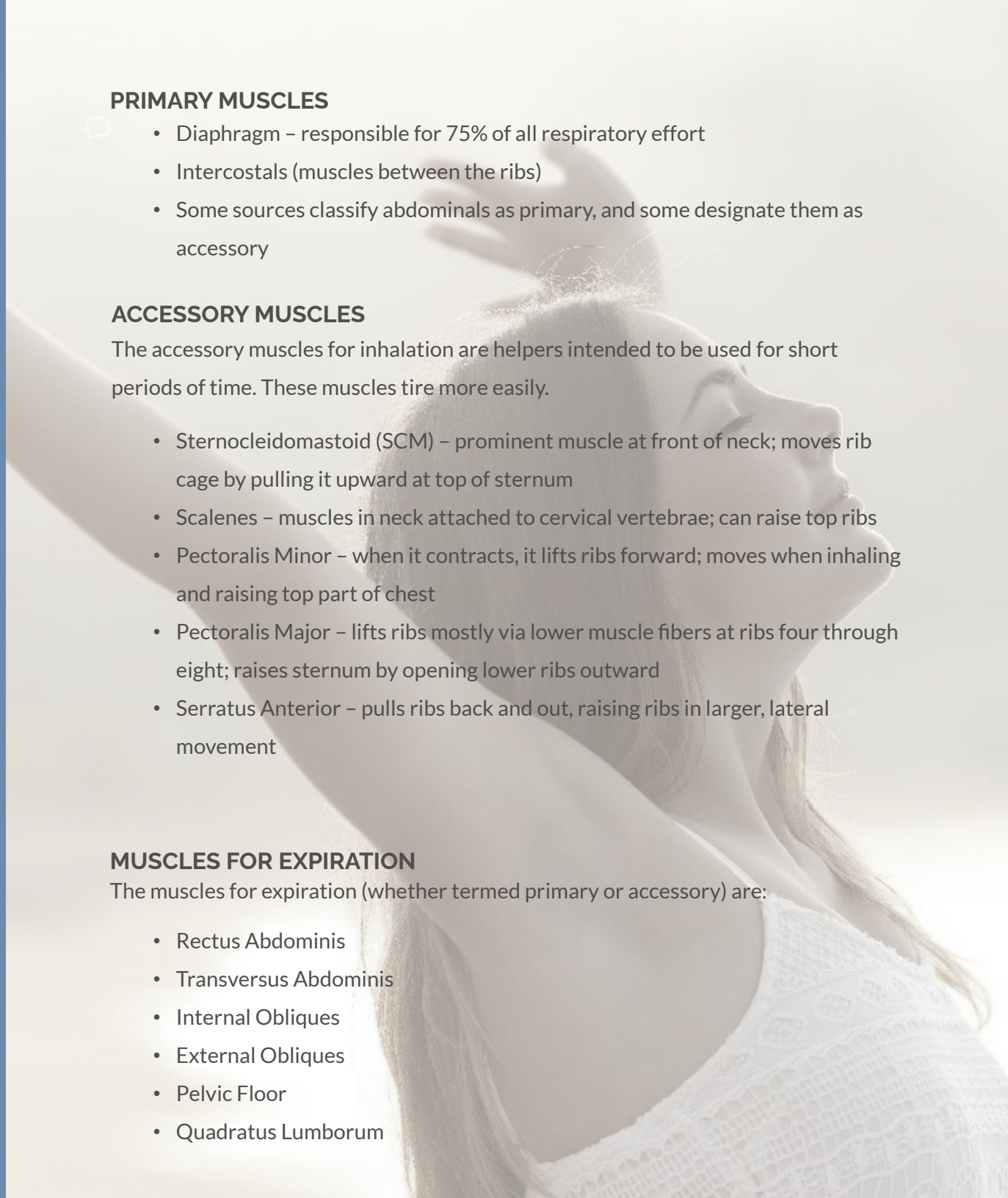
– Timothy McCall M.D.

PRIMARY & ACCESSORY MUSCLES

- Some sources, including Donna Farhi in “The Breathing Book,” classify the abdominals as primary muscles of respiration.

- In “Anatomy of Breathing,” Calais-Germain describes the diaphragm as the "primary inspiratory muscle," but doesn't distinguish between primary and accessory muscles of expiration.

- In “Anatomy of Hatha Yoga,” H. David Coulter doesn't use the terms primary or accessory but includes abdominals in the "main sets of muscles" along with the intercostals and the diaphragm.



PRIMARY MUSCLES

- Diaphragm – responsible for 75% of all respiratory effort
- Intercostals (muscles between the ribs)
- Some sources classify abdominals as primary, and some designate them as accessory

ACCESSORY MUSCLES

The accessory muscles for inhalation are helpers intended to be used for short periods of time. These muscles tire more easily.

- Sternocleidomastoid (SCM) – prominent muscle at front of neck; moves rib cage by pulling it upward at top of sternum
- Scalenes – muscles in neck attached to cervical vertebrae; can raise top ribs
- Pectoralis Minor – when it contracts, it lifts ribs forward; moves when inhaling and raising top part of chest
- Pectoralis Major – lifts ribs mostly via lower muscle fibers at ribs four through eight; raises sternum by opening lower ribs outward
- Serratus Anterior – pulls ribs back and out, raising ribs in larger, lateral movement

MUSCLES FOR EXPIRATION

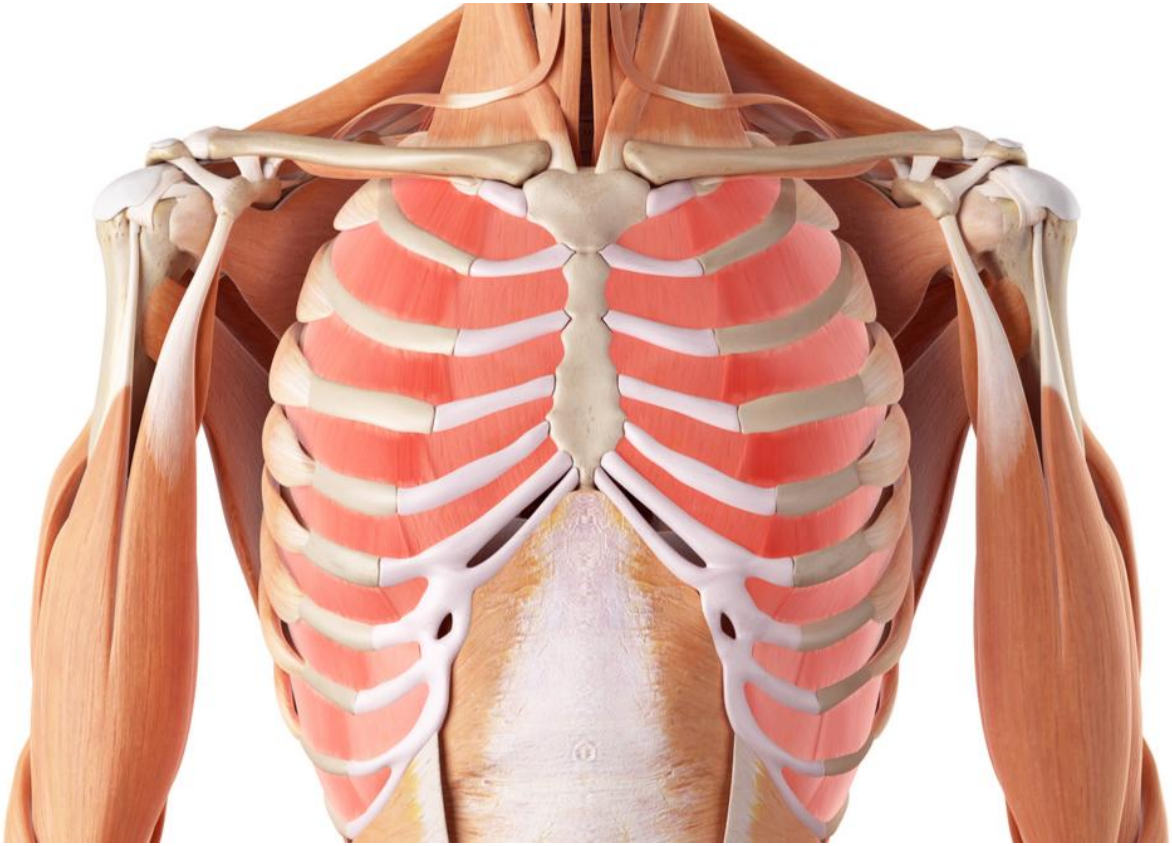
The muscles for expiration (whether termed primary or accessory) are:

- Rectus Abdominis
- Transversus Abdominis
- Internal Obliques
- External Obliques
- Pelvic Floor
- Quadratus Lumborum

THE INTERCOSTALS

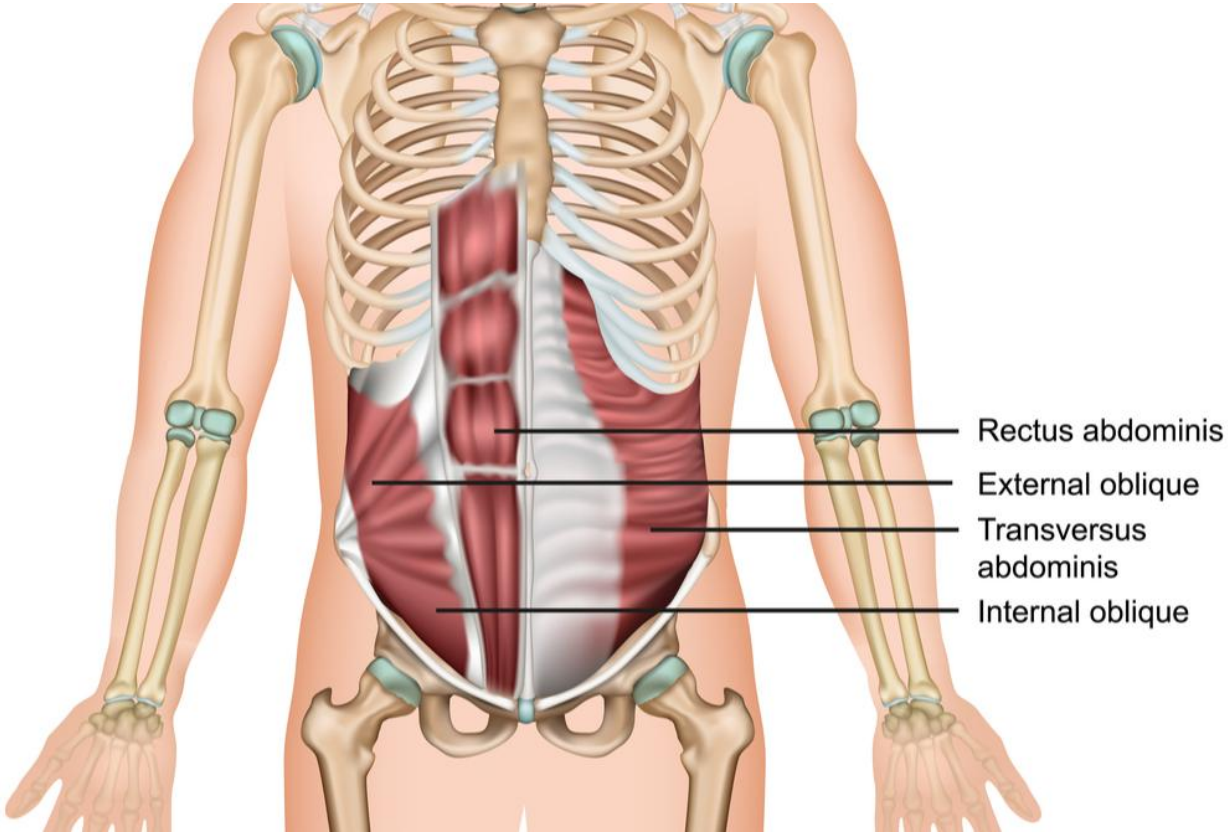
When these muscles are tight, movement of the rib cage is restricted, and therefore so is the breath.

Elongating the intercostal muscles improves breathing.



- Rib movement is caused by muscles between the ribs, called the internal and external intercostals.
- With an inhalation, the intercostals open to expand the ribs and increase space for the lungs.
- They contract during an exhalation.

THE ABDOMINALS IN BREATHING



ABDOMINALS ARE KEY TO BREATHING IN YOGA

The [abdominal] muscles shorten concentrically, pressing the abdominal wall inward, which in turn pushes the abdominal organs up against the relaxed (or relaxing) diaphragm. In combination with the action of the internal intercostal muscles, this forcibly decreases the size of the chest cavity and pushes air out of the lungs... In yoga the abdominal muscles are important for what yogis refer to as even breathing, and they are also key elements for many breathing exercises.

– H. David Coulter

END
RESPIRATORY ANATOMY

Highlights

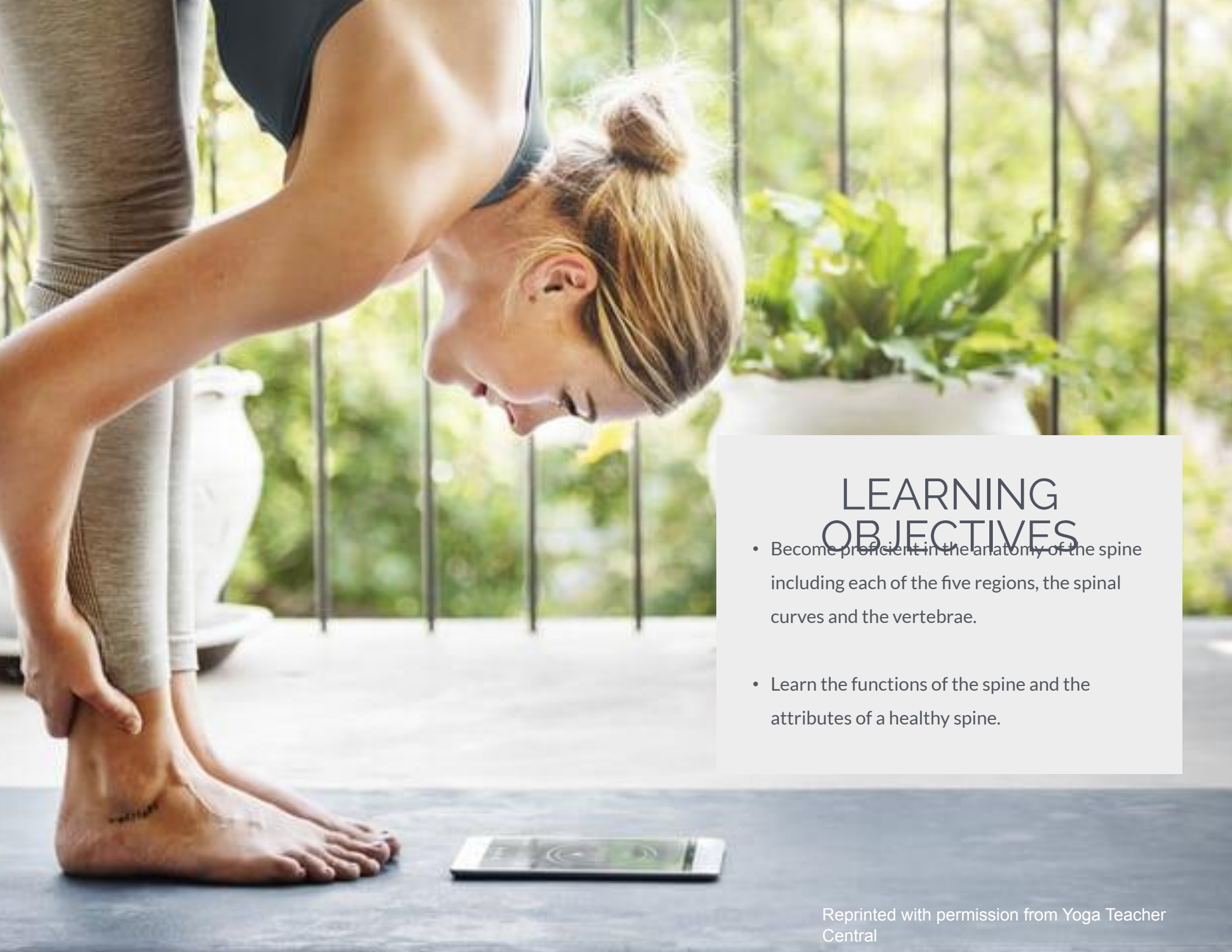
- LEARNING OBJECTIVES
- INTRODUCTION TO SPINE & CURVES
- FUNCTION
- KYPHOSIS & HYPERLORDOSIS
- PRACTICE CONSIDERATIONS

Version 4.0

Your body is like a combination lock — when you find the numbers, it unlocks easily. And one of the numbers is moving toward the natural curves of your spine.

– Rodney Yee

ANATOMY OF THE SPINE



LEARNING OBJECTIVES

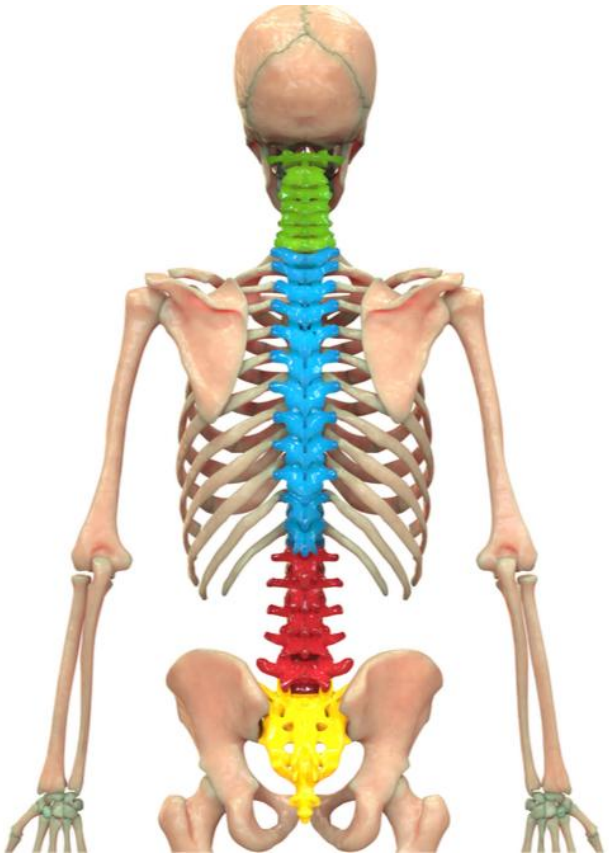
- Become proficient in the anatomy of the spine including each of the five regions, the spinal curves and the vertebrae.
- Learn the functions of the spine and the attributes of a healthy spine.

INTRODUCTION

OVERVIEW OF THE SPINE

- The spine is also known as the spinal column, vertebral column or the backbone.
- The spinal column is made up of 33 specialized bones called vertebrae.
- Because the vertebrae of the sacrum and coccyx eventually fuse, there are, in effect, 24 vertebrae plus the sacrum and coccyx.
- The spine has four "normal curves," a term used by anatomists to underscore their importance.
- Spinal curves are affected by genetics and postural habits.

SPINAL REGIONS



- To see the spinal curves, the spine is viewed from the side.
- There are four curves in a healthy spine.
- The sacrum is the base of the spine and the back of the pelvis.

- The spine is described as having 5 regions: cervical spine, thoracic spine, lumbar spine, sacrum and coccyx.
- The vertebrae are numbered from the top down: C1 to C7, T1 to T12, L1 to L5, and S1 to S5.
- The junctions where the curves of the spine change direction allow the most movement: C7 - T1, T12 - L1, and L5 - S1. For this reason, these points of transition are the most vulnerable to injury. The juncture between the sacrum and lumbar is known to be particularly injury-prone.

SPINAL CURVES

CERVICAL SPINE

- 7 vertebrae: C1 – C7
- Lordotic: convex, curving in toward body
- Most flexible part of spine and therefore often overused

THORACIC SPINE

- 12 vertebrae: T1 – T12
- Kyphotic: curves away from body
- If the curve exceeds 50 degrees, medical sources call it kyphosis
- Generally can twist fairly easily but not bend forward and back as well

LUMBAR SPINE

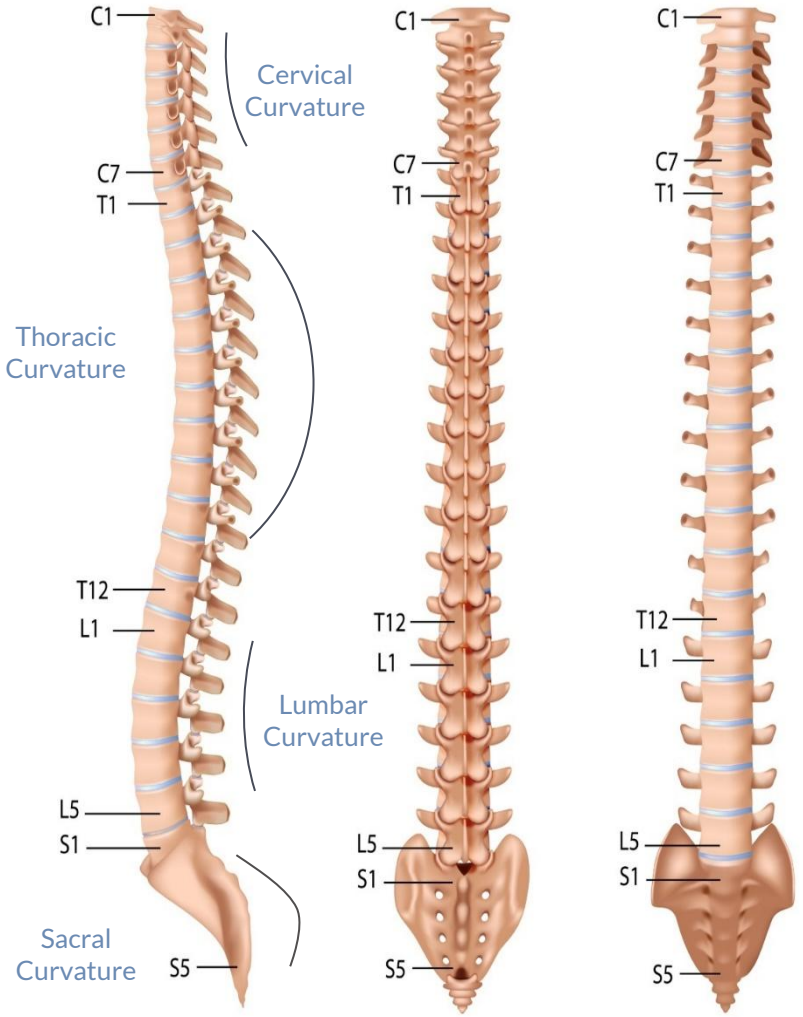
- 5 vertebrae: L1 – L5
- Lordotic: convex, curving in toward body
- Hyperlordosis is excessive curve
- Generally can bend forward and back well but more challenging to twist
- Tight hip flexors can tilt pelvis forward, creating excessive low back curve

SACRUM

- 5 fused vertebrae: S1 – S5
- Kyphotic: curves away from body
- The sacrum is the base of the spine and the back of the pelvis

COCCYX

- 3 to 5 fused vertebrae with a tip that typically points straight down
- Unlike rest of spine, it is dense bone only and does not house spinal cord



FUNCTION

OVERVIEW

- The spine houses the spinal cord which provides communication between brain and body. (The spinal cord is part of the all-important nervous system.)
- It transmits loads between the upper body and the lower body.
- The spine is designed for both movement and stability.
- The curves of the spine work like a coiled spring and provide balance, flexibility, stress absorption and distribution of energy.

FLEXIBILITY, ALIGNMENT & STABILITY

This is a lot to ask of one area and for stability, and a healthy spine demonstrates these attributes.

- Stability is due to the structure of the discs and facet joints.
- Mobility of the trunk is due to the flexibility of the vertebrae.
- "The curves work like a coiled spring to absorb shock, maintain balance, and allow range of motion throughout the spinal column."

> *The stability is created in part by the structures in the column that resemble the legs of a tripod stool. These three structures are the intervertebral disc as one leg of the stool and each of the facet joints as the other two legs. When you stand with all the normal curves undisturbed, that is, in the anatomical position, the curves are in a neutral position, and all three legs of the stool are in contact. This is the position in which the spinal column is the most stable. – Judith Lasater*

KYPHOSIS & HYPERLORDOSIS

FORWARD HEAD

KYPHOSIS

HYPERLORDOSIS

NORMAL CURVATURE

KYPHOSIS / HUNCHBACK

- Excessive forward curvature of the thoracic spine (clinically defined as greater than 50 degrees).
- Symptoms may include an appearance of hunching forward, mild to severe back pain, loss of height, difficulty standing upright and fatigue.
- Potential causes of kyphosis include vertebral fracture due to osteoporosis, congenital malformation of the spinal column, neuromuscular diseases such as cerebral palsy, Scheuermann's Disease (occurring in adolescents), nutritional deficiencies, degenerative conditions due to wear-and-tear such as spinal arthritis with degeneration of discs, and poor posture and slouching.

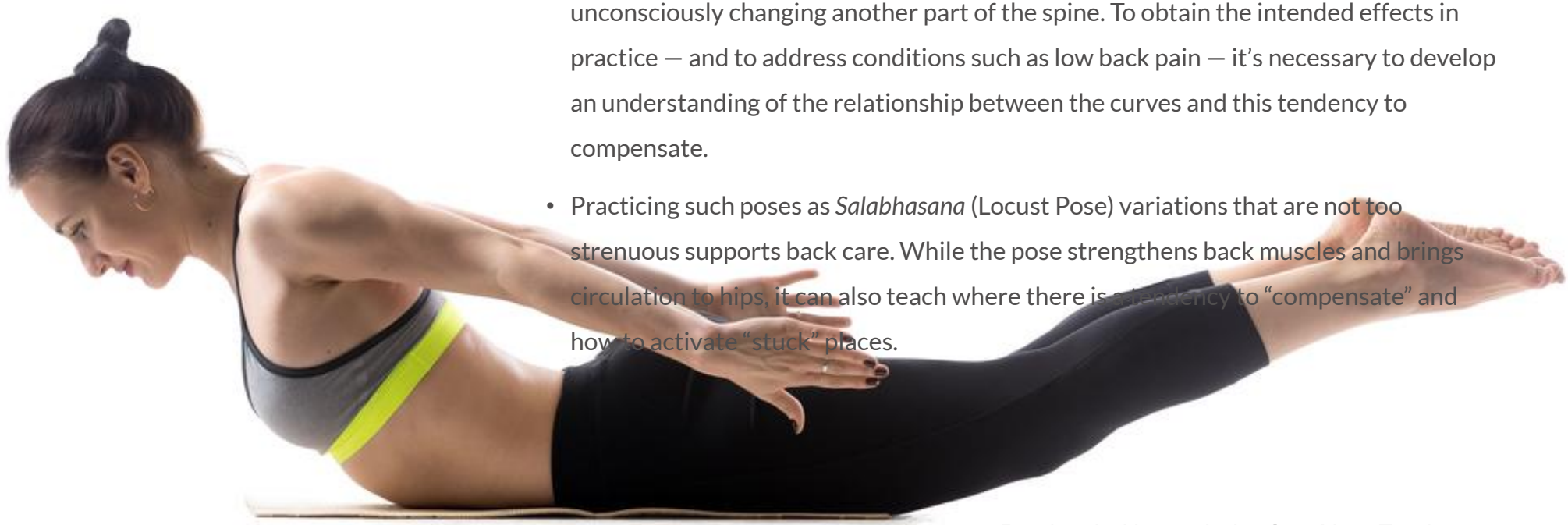
HYPERLORDOSIS / SWAYBACK

- Excessive inward curvature of the lumbar spine.
- Forward (anterior) pelvic tilt.
- Potential causes of hyperlordosis include structural issues such as flat feet or a short leg, abnormal bone growth, neuromuscular disorders such as cerebral palsy, spondylolisthesis, osteoporosis, hip dislocation, obesity, kyphosis, disc degeneration or inflammation, and weak or imbalanced muscles.

PRACTICE CONSIDERATIONS

> *We want to improve movement of the vertebrae that tend to become stuck. As these vertebrae begin to move more easily, the more mobile areas of the spine no longer compensate for the tighter areas.*
>
> *– Susi Hately Aldous*

- An objective of most *asana* practices is to move the spine through its full range of motion. In the case of low back pain or other issues, the restoration of natural curves and healthy related movement patterns is likely a primary need.
- *Tadasana* (Mountain Pose) and other standing poses are often used to develop increased awareness of posture and habits, and to learn actions that help with alignment and balance.
- If there is hyperlordosis and rib shear, experiment with softening the front ribs back to neutral as opposed to excessive tucking of the pelvis. (See Anatomy of the Pelvis for more information.)
- When flexing or extending a part of the spine, there is a tendency to compensate by unconsciously changing another part of the spine. To obtain the intended effects in practice — and to address conditions such as low back pain — it's necessary to develop an understanding of the relationship between the curves and this tendency to compensate.
- Practicing such poses as *Salabhasana* (Locust Pose) variations that are not too strenuous supports back care. While the pose strengthens back muscles and brings circulation to hips, it can also teach where there is a tendency to "compensate" and how to activate "stuck" places.



END
SPINAL ANATOMY

ANATOMY OF THE CORE

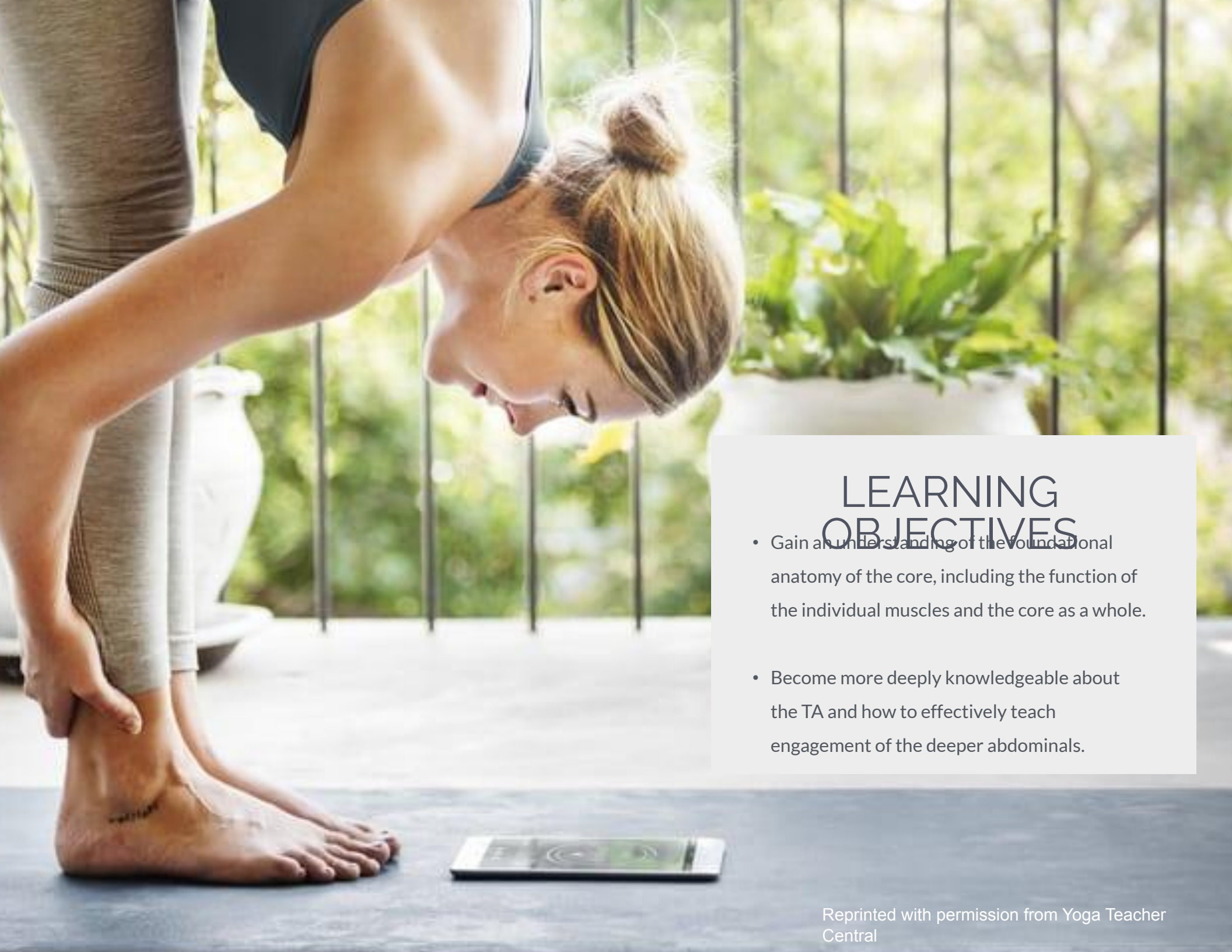
Highlights

- LEARNING OBJECTIVES
- THE TRANSVERSUS ADBOMINIS
- ENGAGING THE TA
- CORE STRENGTHENING
- PRACTICE CONSIDERATIONS

Version 3.5

Your core most often acts as a stabilizer and force transfer center rather than a prime mover. Yet, consistently people focus on training their core as a prime mover and in isolation.

– Jeff Kuhland



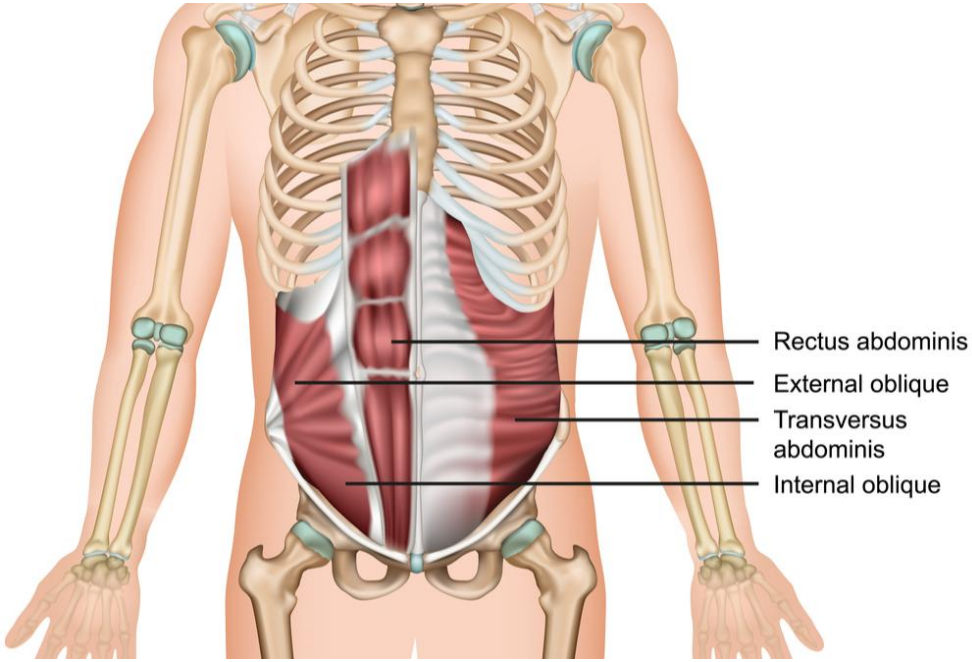
LEARNING OBJECTIVES

- Gain an understanding of the foundational anatomy of the core, including the function of the individual muscles and the core as a whole.
- Become more deeply knowledgeable about the TA and how to effectively teach engagement of the deeper abdominals.

INTRODUCTION

OVERVIEW

- The core includes many different muscles that stabilize the spine and pelvis.
- The term “core” often refers to the abdominal muscles (outer and deep) and back muscles including the erector spinae and mulitfidus muscles.
- More refined definitions also include the diaphragm and pelvic floor. Some definitions include the inner thighs and/or more muscles.



CORE COMPONENTS

- **Rectus Abdominis** Bends spine forward and compresses the abdominal contents. Worked in Navasana (Boat Pose).
- **Internal & External Obliques** Twist torso and bend it sideways. Worked in Ardha Matsyendrasana (Half Lord of the Fishes Pose).
- **Transversus Abdominis (TA)** Wraps around torso and supports spine. Worked in Plank Pose.
- **Erector Spinae** Three groups of muscles running the length of either side of the spine. Help to maintain erect posture, stabilize spine during flexion, and assist in side bending and spinal rotation.
- **Multifidus Muscles** Series of deep muscles that run the length of the spine. Stabilize vertebrae as well as assist in spinal rotation and extension.

When you laugh until your belly aches, you are feeling your TA. It is also the muscular focus in Kapalabhati Pranayama. When properly toned, this muscles keeps your organs in place while giving support to the lumbar spine. When habitually gripped, it compresses the organs and lends to abdominal hernias, urinary incontinence, and digestive problems.

– Mark Stephens

THE TRANSVERSUS ABDOMINIS

- A significant amount of expert teaching around core recruitment and strengthening is focused on the transversus abdominis (TA).
- The TA is the deepest of the abdominal muscles.
- “There is one transverse muscle on each side joined by a fascial sheet that connects them and allow them to act as one solid muscle.” (Core Walking)
- The TA wraps around the abdomen between the lower ribs and top of the pelvis.
- The TA supports the abdominal wall, aids forced expiration, and stabilizes the spine and pelvis before movement of the limbs.
- The Transverse Abdominis helps with overall core stability.
- When the TA engages / contracts, it has a “corset-like” effect, slightly narrowing the waist and flattening the lower abdomen

ENGAGING THE TA

YOU CAN'T STRENGTHEN A MUSCLE YOUR BRAIN CANNOT ACTIVATE

The first step is to learn to isolate the [TA], to train it to contract. Research has clearly shown that the better you are at isolating this muscle, the faster it will integrate into functional tasks. The second step is to strengthen or teach it to co-contract with the other muscles of the core, the deep multifidus and the pelvic floor as you breathe. The final step is to co-contract the entire core (connect to the entire core) and use this connection in functional activities. You cannot strengthen a muscle your brain cannot activate.

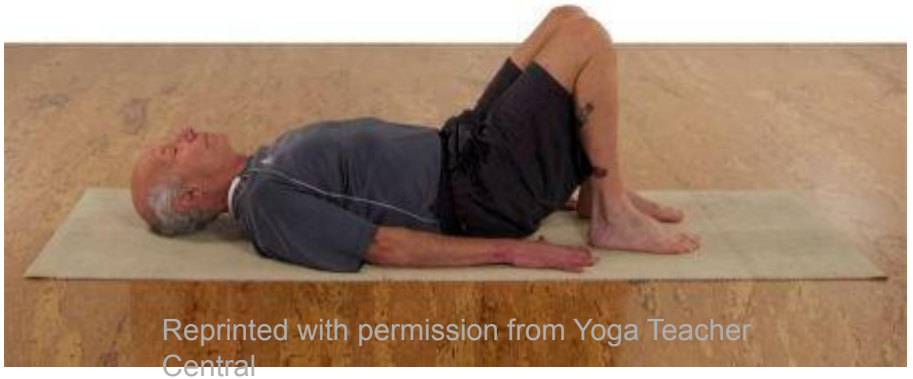
- Diane Lee & Assoc Physiotherapy

IDENTIFYING THE DEEPER ABDOMINALS

- Identifying the TA can be a fundamental step in learning to properly activate the core. And yet, it can be challenging for students to learn to feel their deeper abdominals.
- Learning to contract the TA can be vital for students who — thinking they are engaging their core — are actually just pulling up their diaphragm and abdominal contents.
- Engaging the deep abdominals is typically easiest on exhale.
- Laughing and coughing use the deeper abdominals.

EXERCISES TO ENGAGE THE DEEPER ABDOMINALS

- Breathing exercises can help students gain awareness of their deeper abdominals. Such practices include focusing on the exhalation and Kapalabhati Pranayama.
- A common teaching is to lie on the back with feet on the floor. Palpate for the hip points. Then lengthen the spine to draw the hip points toward one another.
- If the belly poofs out, it may be a sign the student is engaging only the rectus abdominis (the more superficial abdominals).
- Another exercise is to sit tall and, on the exhale, hug the waist in from the front, back and sides. Release on the inhale.
- Another consideration Is Pelvic Tilts (on back or against wall) combined with TA awareness teachings.



FUNCTIONS OF THE CORE

- Contains and protects the internal organs.
- Ensures greater mobility of the spine and trunk.
- Stabilizes the top part of the body over the bottom part.
- Controls the pelvic-lumbar relationship.
- Transfers force during movement.

ABOUT STABILIZATION

STABILIZERS & PRIME MOVERS

Stabilizers are the muscles that keep your back in alignment. They are also the muscles that hurt when you lift a weight with your back rounded. But which muscles are these, exactly? They are the small muscles of the lower back and the central spine. Prime movers are muscles that aren't attached directly to the lower back or the central spine. They are large, because their job isn't to hold the small bones of the back in place but to provide locomotion... The stabilizers can be misused to move things, but that takes them out of the stabilizer role. The prime movers can be used only to move things. – SuppleCity.com

WHAT DOES STABILIZATION MEAN?

Stabilization means being able to control the amount of movement of your joints during movement of your body. Stability is not about how much movement you have but about how well you can control it. The activation of specific core muscles allows you to stabilize your joints and control movement.

– Grand River Sports Medicine Centre

CORE STRENGTHENING

- Modern lifestyle habits tend to lead to weak abdominals. As a result, many people use back muscles to compensate, which can cause injury.
- If the TA is weak, it can lead to low back stress and an overworked psoas.
- Choose practices that use the core muscles as stabilizers. (See Core Anatomy for more information.)

BENEFITS

- A strong core can be thought of as "building strength from the inside out" and is often correlated with positive psychological, emotional and spiritual states, including feelings of strength and resilience.
- Core strengthening supports the low back and can reduce or eliminate back pain.
- Strong abdominal muscles support abdominal organs
- A healthy core improves posture.
- A healthy core improves digestion and elimination and in yoga is associated with healthy digestive "fire."
- A strong core improves athletic performance.

PRACTICE CONSIDERATIONS

- Think about your movement as coming from the body's center of gravity just below the navel.
- A healthy core acts as both a stable base and a fluid source of movement. Abdominal muscles should be toned but not tense.
- A fundamental step in developing a healthy core is to learn to sense (feel) the deep core.
- Sit-ups refer to lifting the entire back off the ground to a sitting position. Crunches lift only head and chest until abdominals engage. Sit-ups have a relatively high risk of injury. (healthline) Crunches isolate abdominals, but only the outermost abdominals. Neither sit-ups nor crunches may be the best choice for core strengthening. Sit-ups and crunches flex the trunk forward, a movement most people do in excess.
- The concept of "stabilizers" and "prime movers" can help with understanding core health and choosing effective strengthening movements. A balanced approach to core health includes utilizing the abdominals as stabilizers (not prime movers).

Here's the good news: core work doesn't have to mean crunches! In fact, crunches and sit-ups are becoming somewhat passé, with many fitness experts considering them outdated, ineffective, and potentially injurious.

– Kat Heagberg

PRACTICE EXERCISE

The following exercise (as shared by Judith Lasater in Yoga Abs) is designed to help you have the experience of feeling the abdominal muscles in their role as stabilizers.

1. Lie on back, legs together, knees facing up.
2. Lift one leg off floor, noticing contraction of abdominals. This is an example of the abdominals stabilizing the trunk.
3. Now place thumbs on lower ribs and middle fingers on iliac crests (hip bones).
4. Lift leg about 5 inches off the floor and then outward about 10 inches.
5. If abdominals are stabilizing, there will be no lifting of opposite-side pelvis; the greater the movement experienced, the less stabilization the abs are providing.
6. "Not only is this exercise a good way to become aware of your habit of not stabilizing your abdominals when you move your legs, it can also be a strengthening exercise that you can incorporate into your regular asana practice."

END
CORE ANATOMY