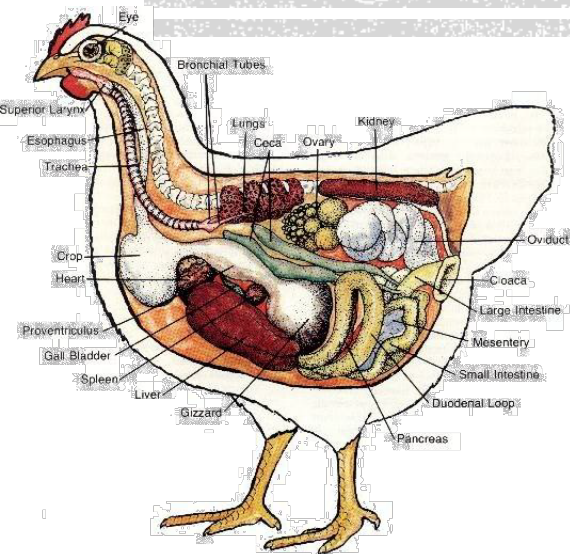


ANATOMY AND PHYSIOLOGY OF POULTRY

Parts and Purpose



WHAT IS DIFFERENT ABOUT THE BIRD COMPARED TO MAMMALS?

- Feathers
- Hollow bones
- Lack teeth
- Lay eggs
- Float and fly
- Waste excreted from only one orifice



WHAT IS ANATOMY?

- Anatomy: the science of the structure of animals.
- Derived from the Greek work “to cut up.”



WHAT IS PHYSIOLOGY?

- **Physiology:** the science that deals with the functions of the living organism and its parts.



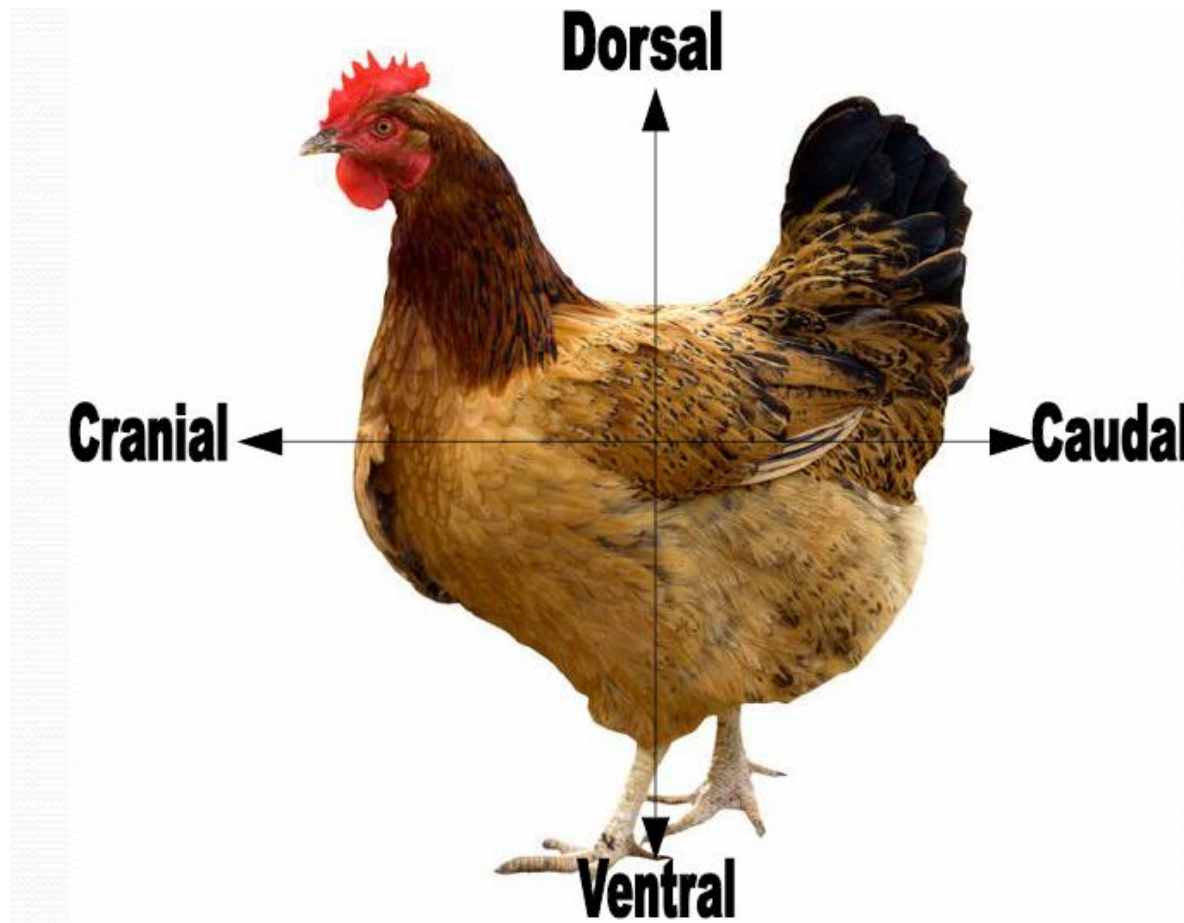
ANATOMICAL TERMS

The following terms are used to describe locations on the animal body.

- **Dorsal:** pertains to the upper surface of the animal.
- **Ventral:** relates to the lower and abdominal surface.
- **Cranial (or anterior):** applies to the front or head.
- **Caudal (or posterior):** pertains to the tail or rear.



ANATOMICAL DIRECTIONAL TERMS



BODY SYSTEMS OF POULTRY

- Integumentary
- Skeletal
- Respiratory
- Circulatory
- Urinary
- Reproductive
- Digestive

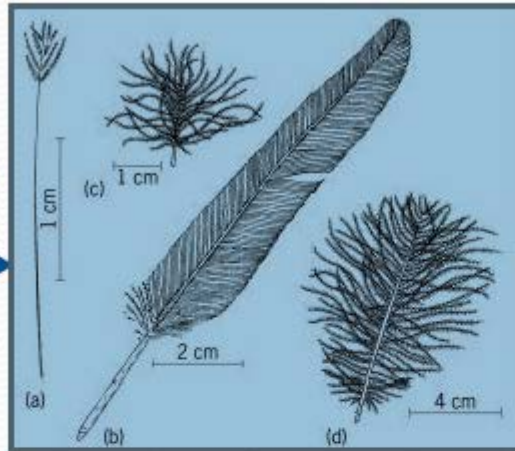


INTEGUMENTARY SYSTEM

- The skin, feathers, and beak.
 - Function: to protect the bird from external harm.
- Skin
 - Much like humans, with the exception of plumage production.
 - **Plumage**: the outer covering of a bird's body.
 - Feathers, scales, filoplumes.
 - **Filoplumes**: hair-like structures located at the base of feathers.
 - **Wattle**: a red growth underneath the beak, which works in conjunction with the **comb**, an excess of skin on top of their head.
 - Function: regulate the temperature of the bird by circulation of blood between the two
 - Also combs attract mates
 - The size of the comb is an indication of the levels of testosterone in the body. If the comb is large, then this means more testosterone is present, often meaning the sex of the bird is male.

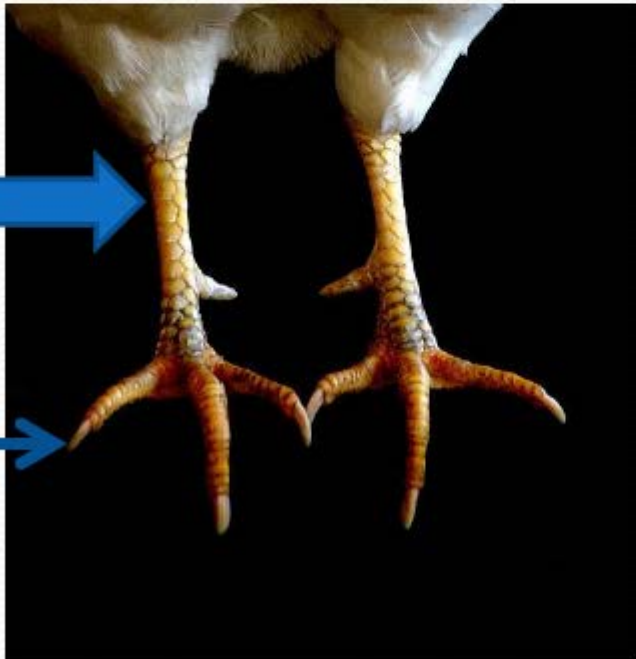


Filoplume



Scales

Nails

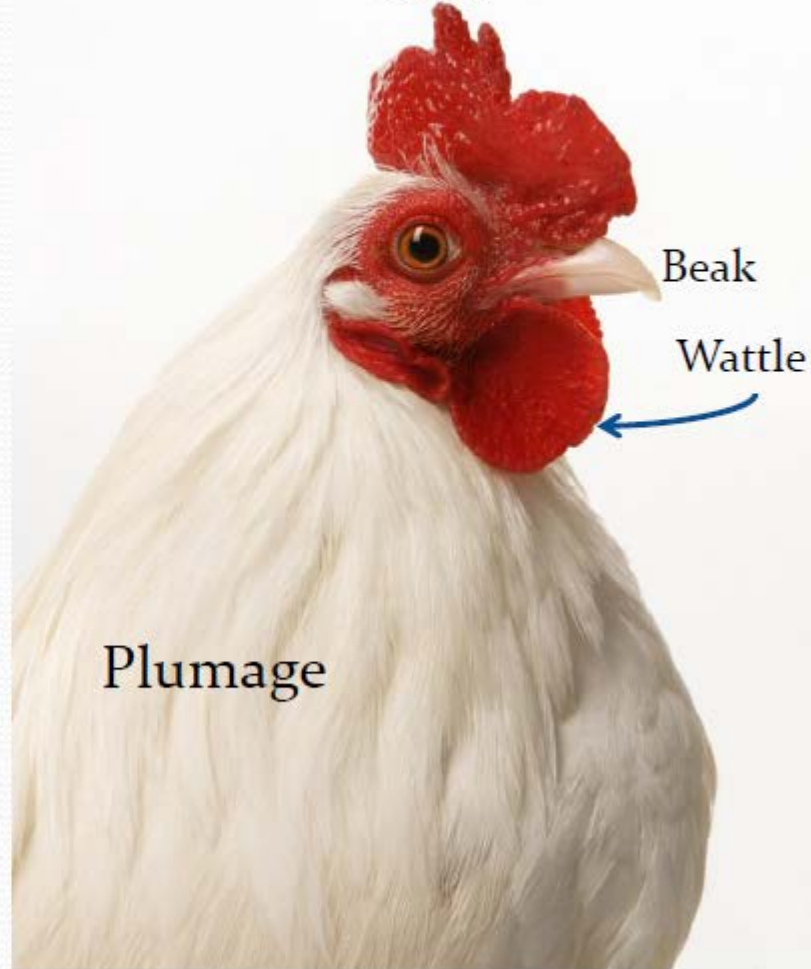


Comb

Beak

Wattle

Plumage

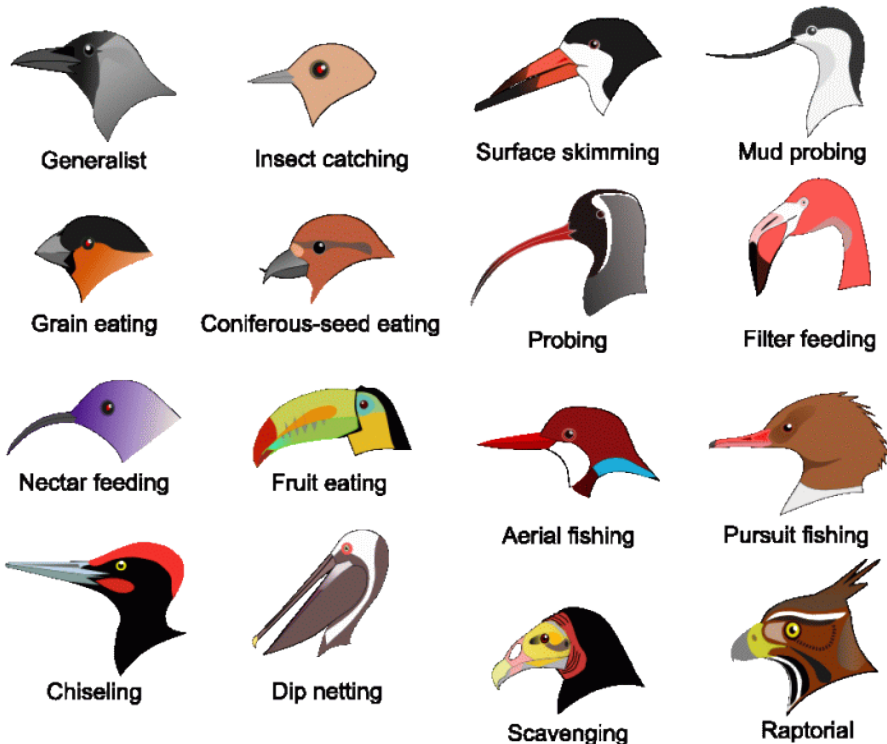


SCALES AND PLUMAGE

- Scales are located on the legs and feet.
- The plumage is always for altered shape.
 - Function: body cooling and heating for maintenance of body temperature, protects against abrasions and bruises when birds are in groups or lying on the ground.
 - Plumage shape is particularly important for cooling since birds lack sweat glands.
 - Although it is not common for production birds to fly, plumage type and form is an important determinant in flight for aerial species
 - Plumage can also be used to sex your birds



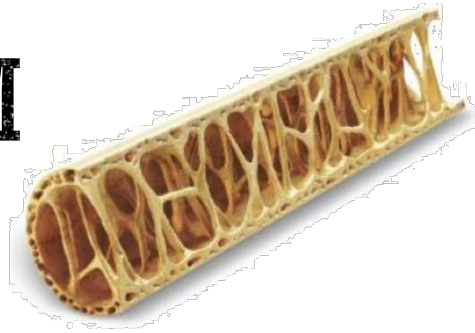
BEAKS VS. LIPS AND TEETH



- Birds have beaks as opposed to lips and teeth.
- The beak is used for eating and drinking, preening as well as in self-defense and protection from other animals.
- It is shaped according to what a bird eats



SKELETAL SYSTEM



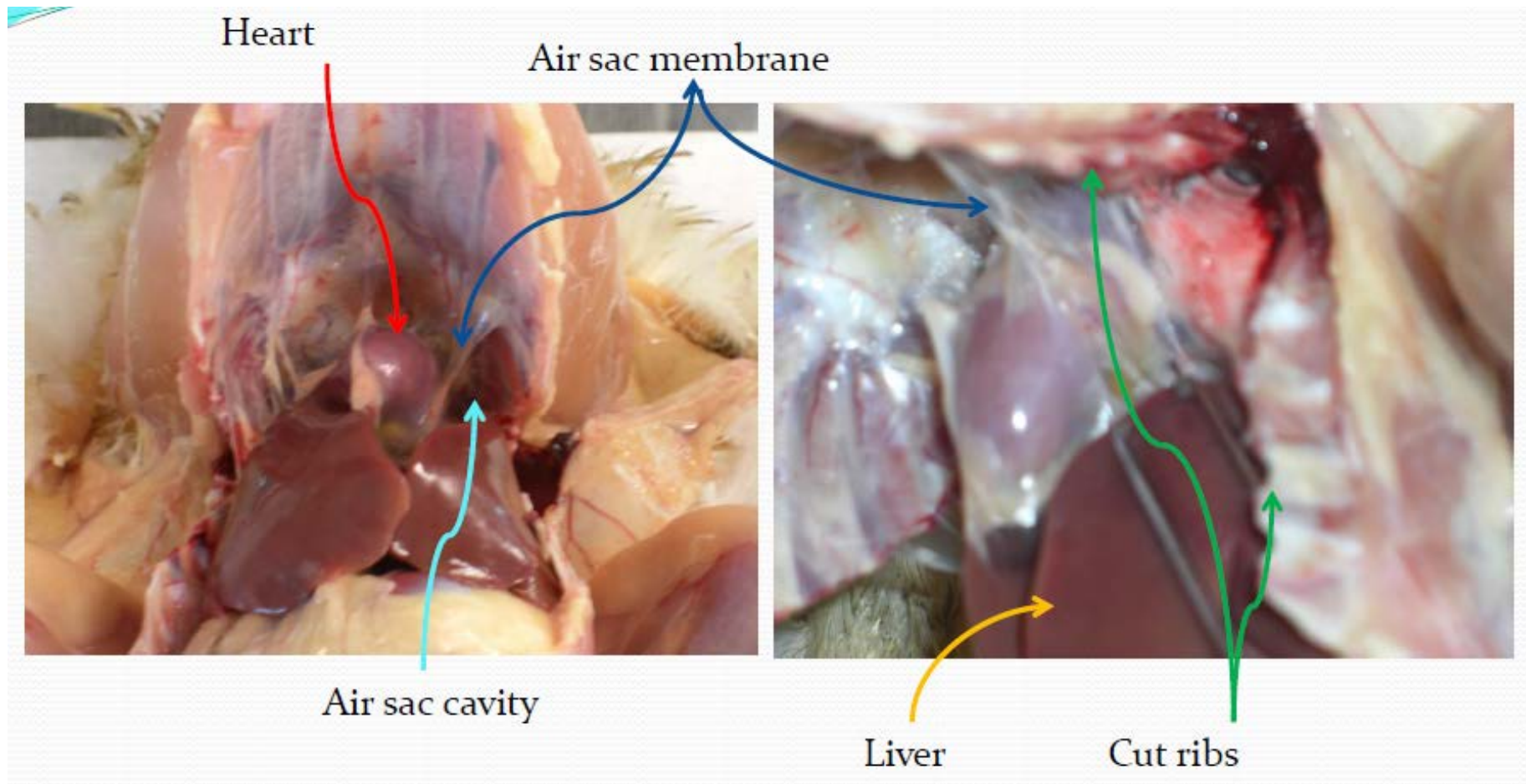
- **Pneumatic Bones**
 - Poultry have ***pneumatic***, or hollow, bones.
 - Connect with the respiratory system.
 - Their light weight is an adaptation for flight.
- **Medullary Bone**
 - ***Medullary*** bone contains high amounts of calcium.
 - Storage source is used by the *female hen* to produce the egg shell during reproductive periods.
- **Fused Bones**
 - Bones in the foot, or ***shank***, are fused.
 - Causes birds to walk upright.
 - Many vertebrae along the backbone are fused for the purpose of flight.



RESPIRATORY SYSTEM

- Vastly different than the mammalian respiratory system.
- Unlike mammals, birds lack a diaphragm to inflate and deflate the lungs.
 - Instead, birds have nine ***air sacs*** located in the neck region and body cavity that function to inflate the lungs.
 - Gas exchange occurs in the Avian lung and the air sacs function to move air in and out of the respiratory system.





Bird Respiration

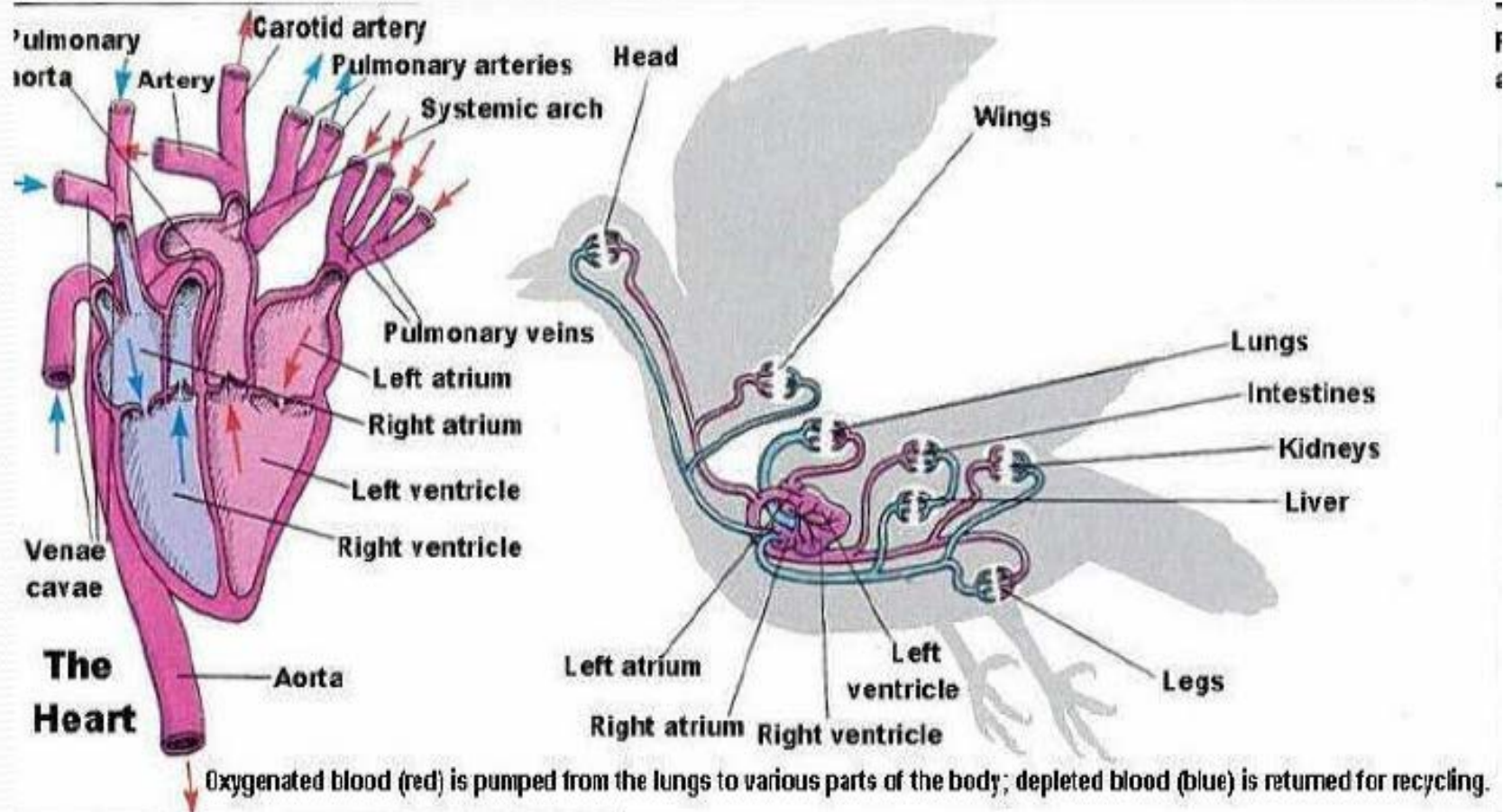


RESPIRATORY SYSTEM

- Breathing process has two phases: inhalation and exhalation.
 - **Inhalation:** when the bird breathes in, air bypasses the lungs and enters the posterior air sacs. At the same time, air in the lungs from the last exhalation phase exits the lungs and enters the anterior air sacs.
 - **Exhalation:** the bird releases air from the posterior air sacs, which enters the lungs. The air that filled the anterior air sacs from the inhalation phase is then released from the body through the trachea.
- **Nares** are the nostrils located on the beak. Their purpose is the passageway for air to be breathed in and out of the trachea.

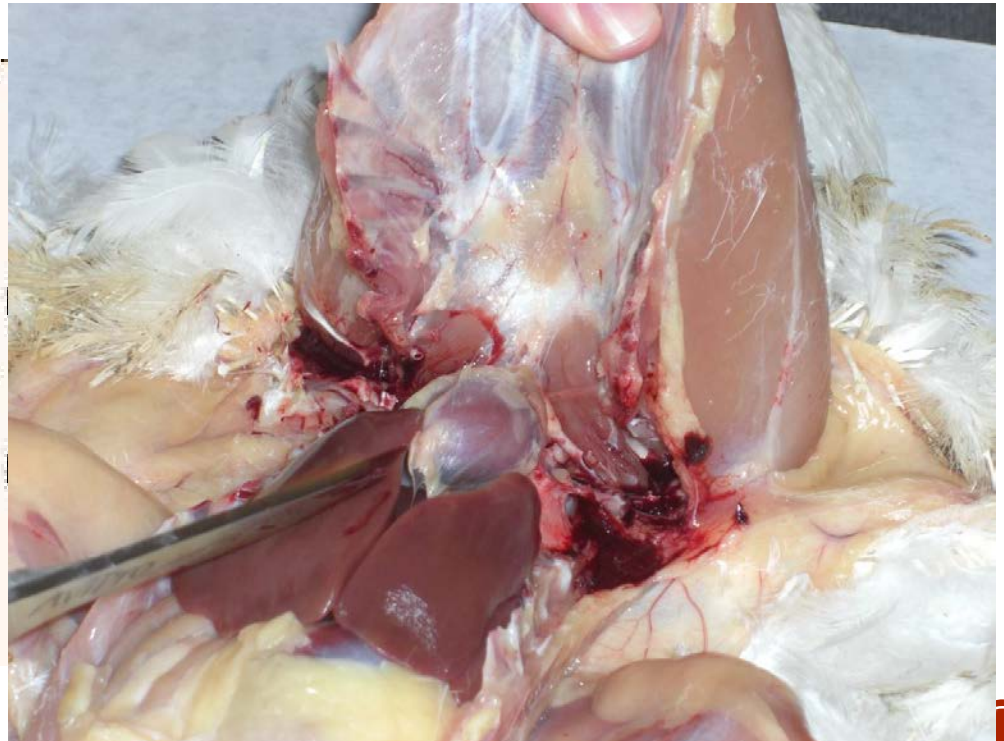
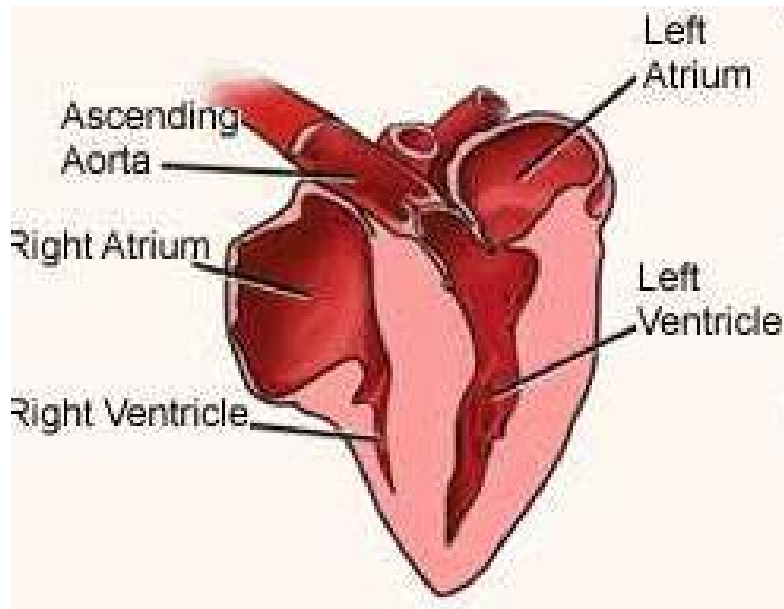


Circulatory System



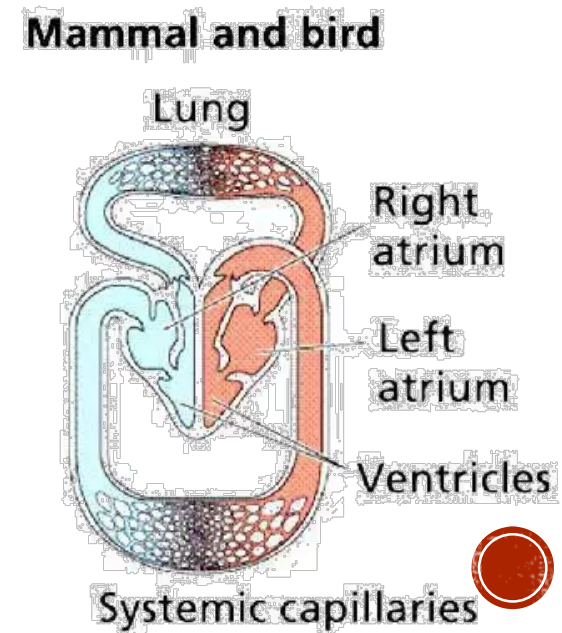
HEART

- The heart pumps blood throughout the body to deliver oxygen and nutrients to tissues and to remove carbon dioxide and metabolic waste from tissues.



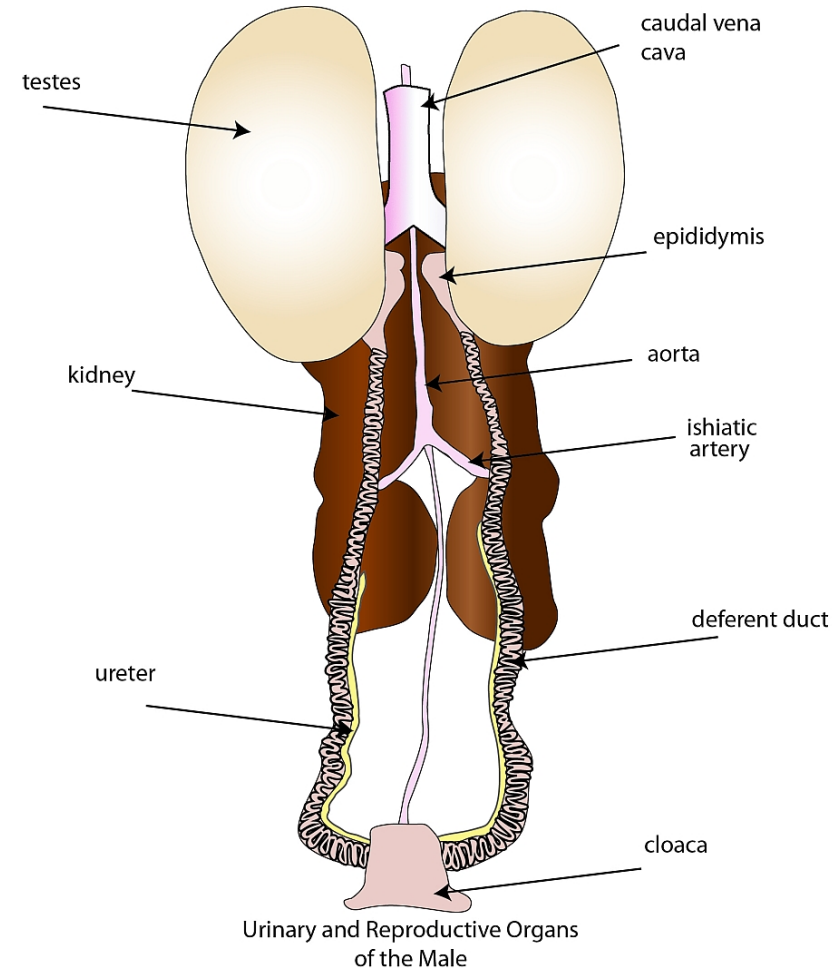
BLOOD VESSELS

- **Arteries:** carries blood from heart & to the rest of the body.
- **Arterioles:** directs blood to certain tissues of the body.
- **Capillaries:** site of exchange between blood and tissues.
- **Veins:** brings oxygenated blood back to the heart.

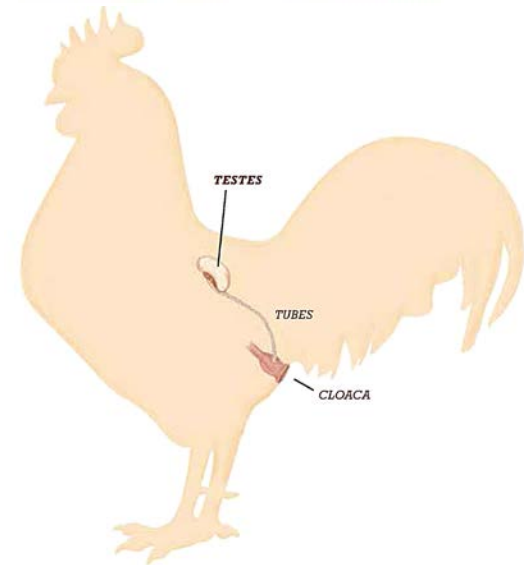
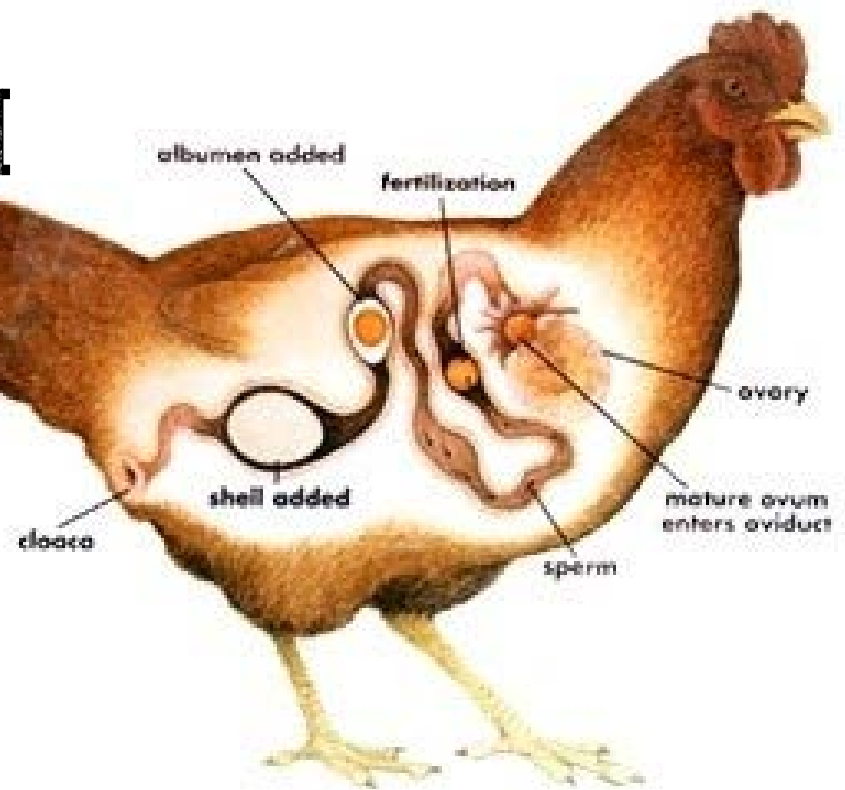
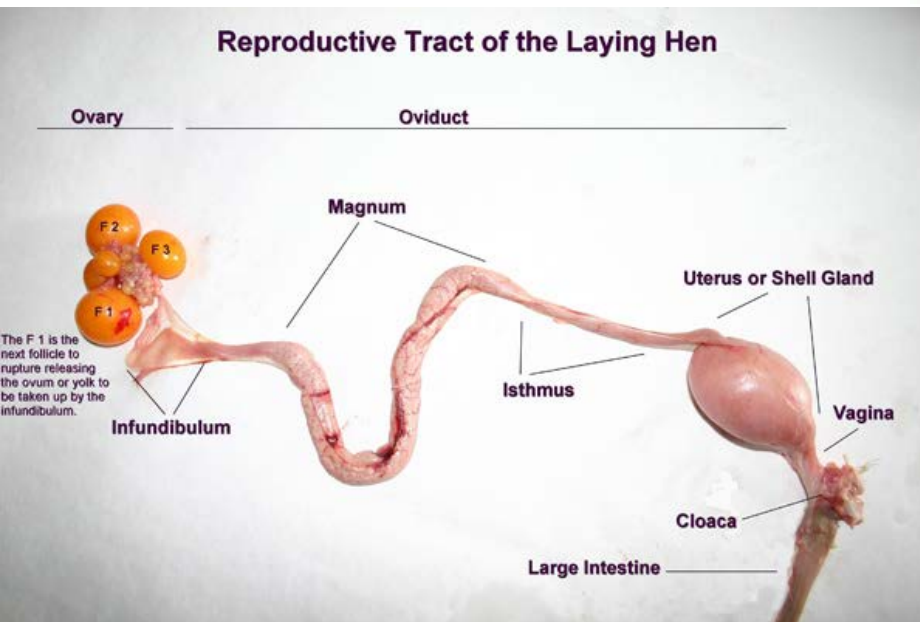


URINARY SYSTEM

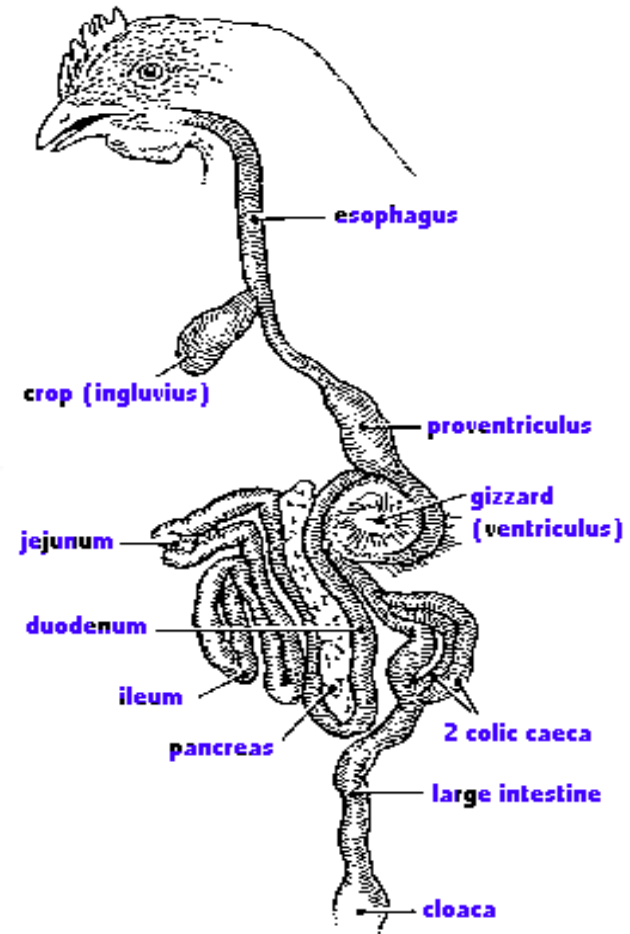
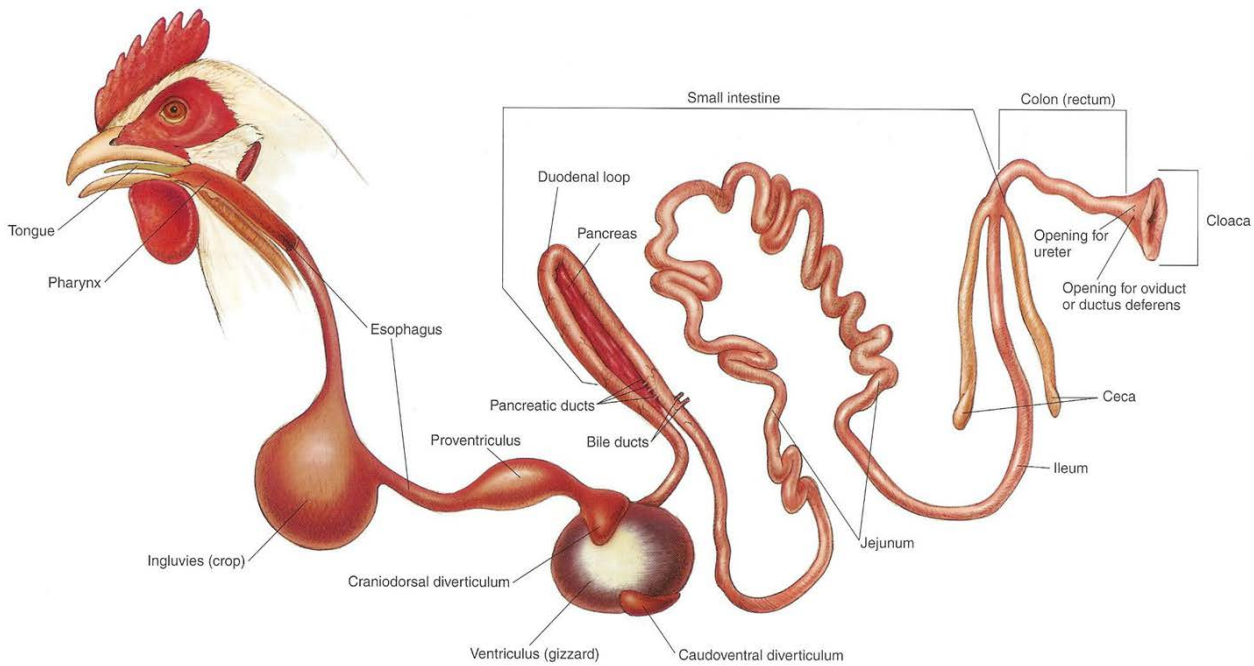
- **Kidneys**
 - Two multi-lobular structures located in the rib cage.
 - Produce urine by removing waste products from the blood.
- **Ureters**
 - Transports the liquids kidney filtrate from the kidneys to the cloaca for excretion.
 - Birds do not have a bladder.
 - Urine is not stored, but rather excreted when produced.
- **Cloaca**
 - Feces and urine exit out of the bird's body through this region in the abdominal cavity.
- **Uric Acid Excretion**
 - Poultry excreta contain ***uric acid***.
 - Very high in nitrogen due to its lowered water content, is semi-solid.



REPRODUCTIVE SYSTEM

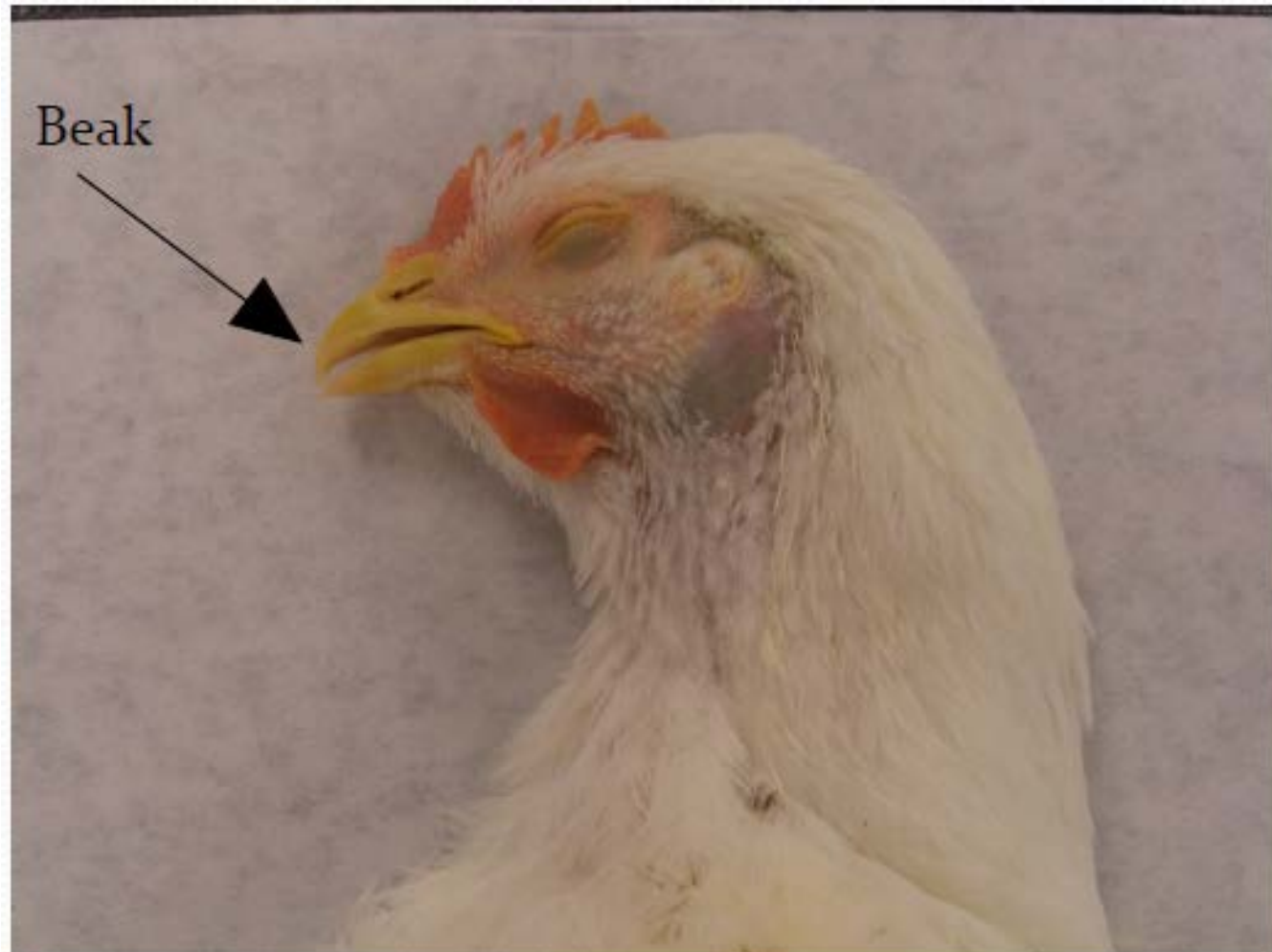


DIGESTIVE SYSTEM



PARTS OF THE MOUTH

- Tongue
- Beak
- Taste buds



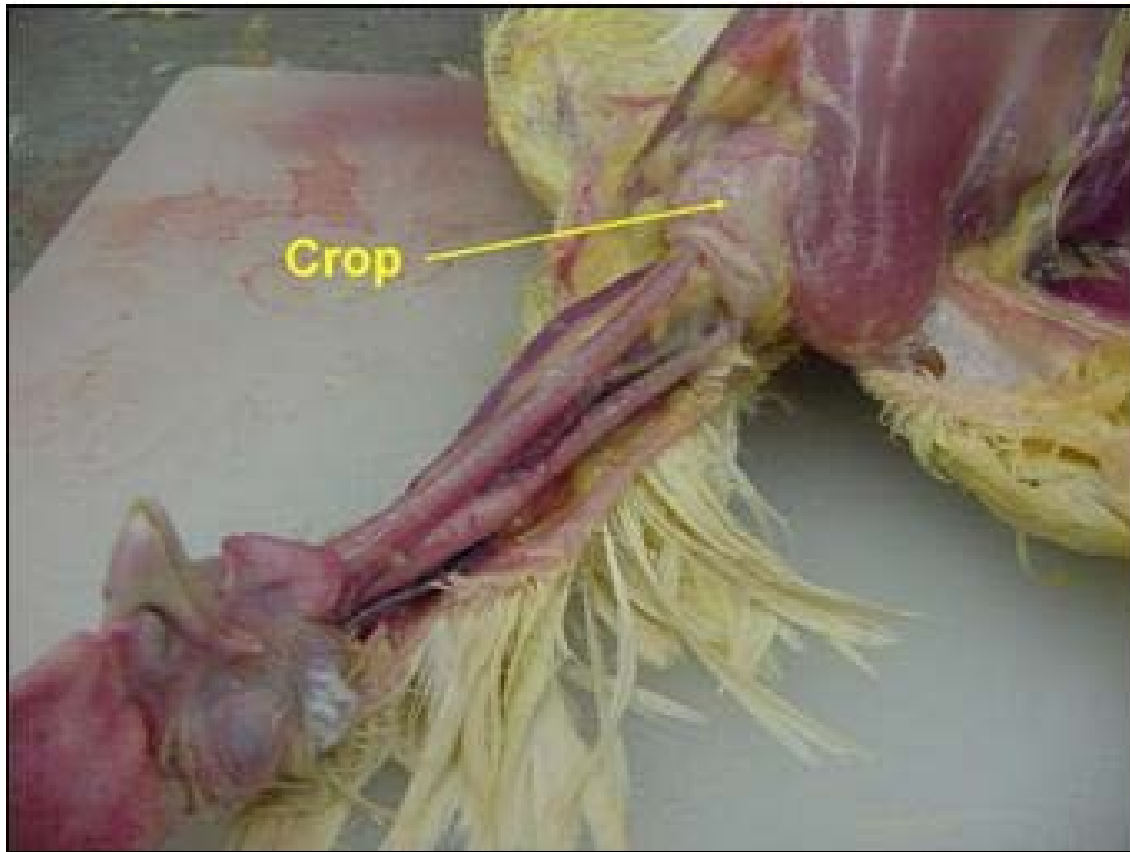
ESOPHAGUS

- Flexible tube that connects mouth to the crop.

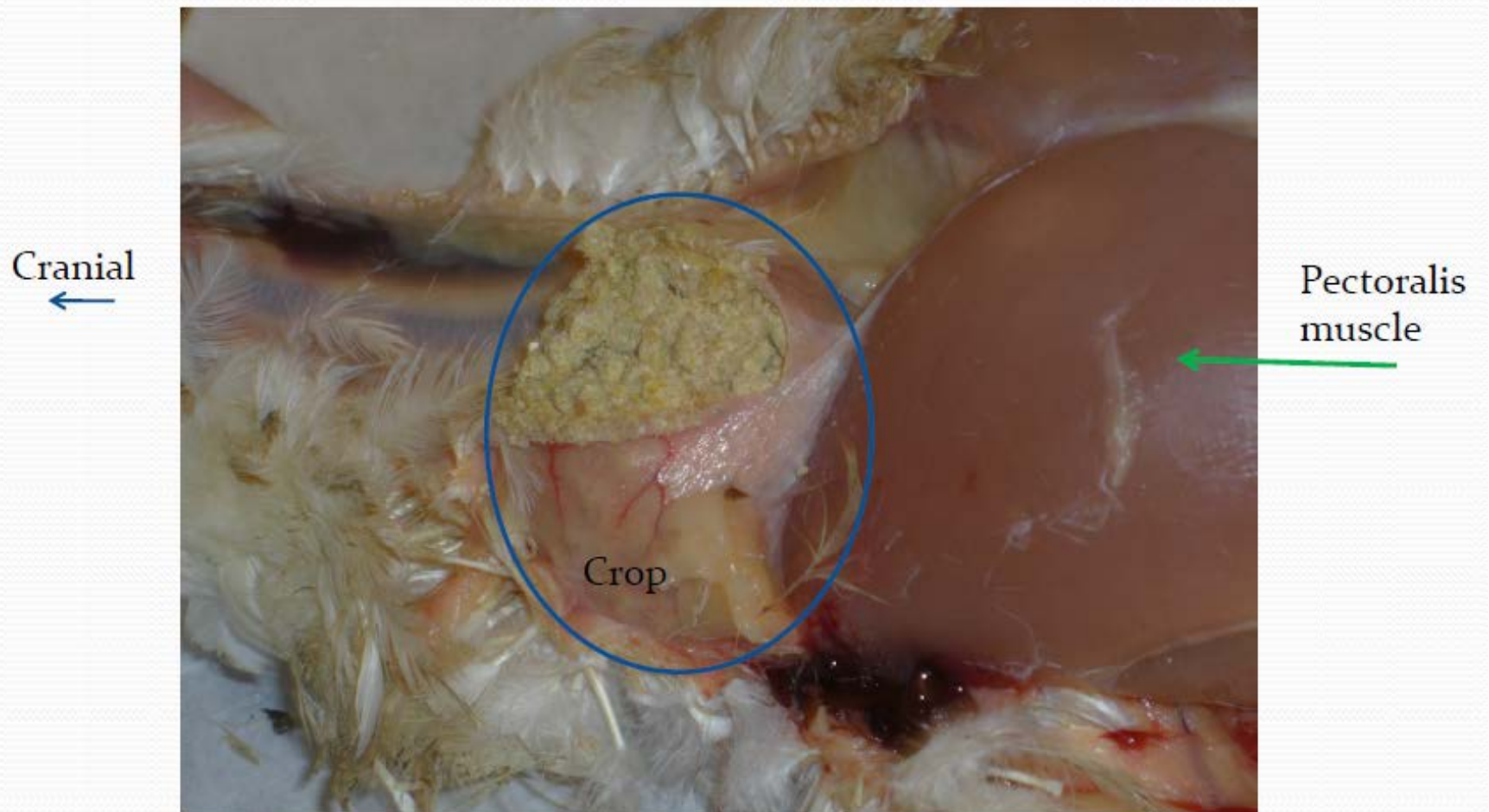


CROP

- An expanded, muscular out-pocketing of the esophagus located just outside the body cavity in the neck region
- Function: moistens and temporary stores food

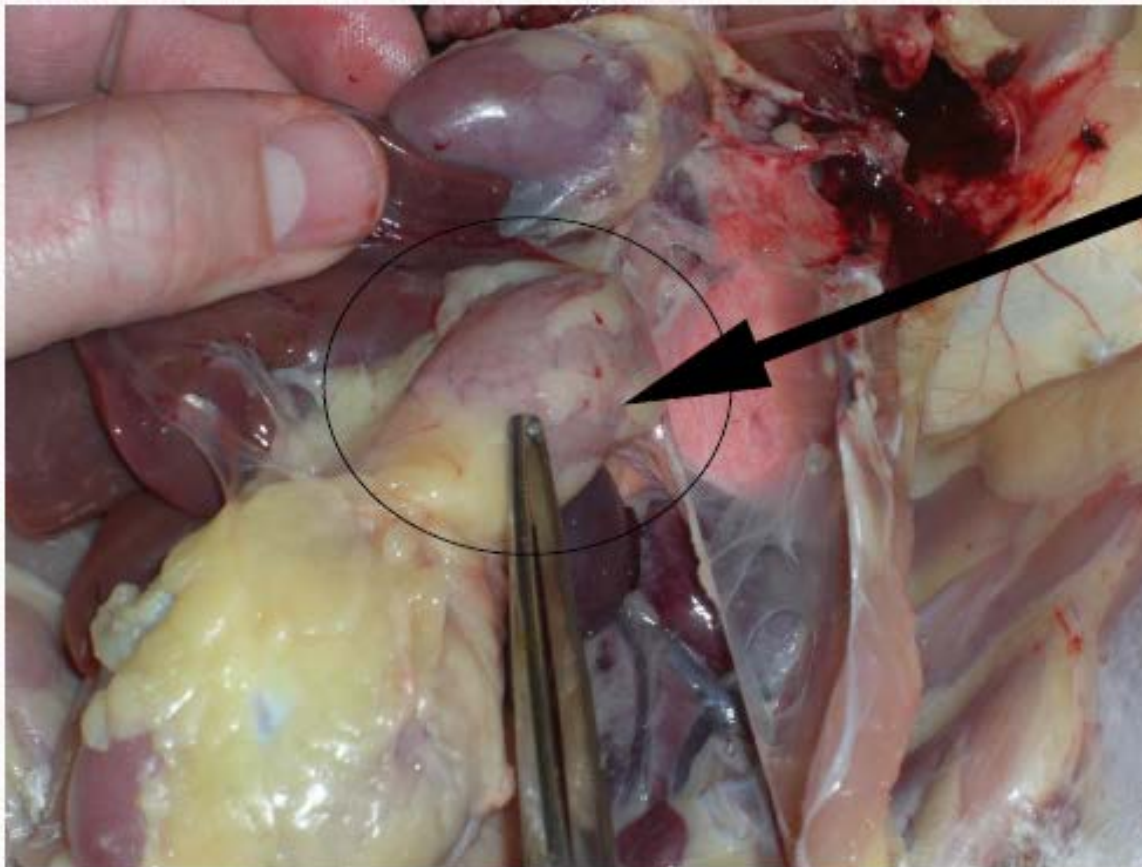


This is a picture of an opened crop. Notice the yellow feed pellets that have been moistened while they were stored in this chicken's crop.



PROVENTRICULUS

- The “true” stomach of the bird.
- Function: uses acids and digestive enzymes to breakdown food.

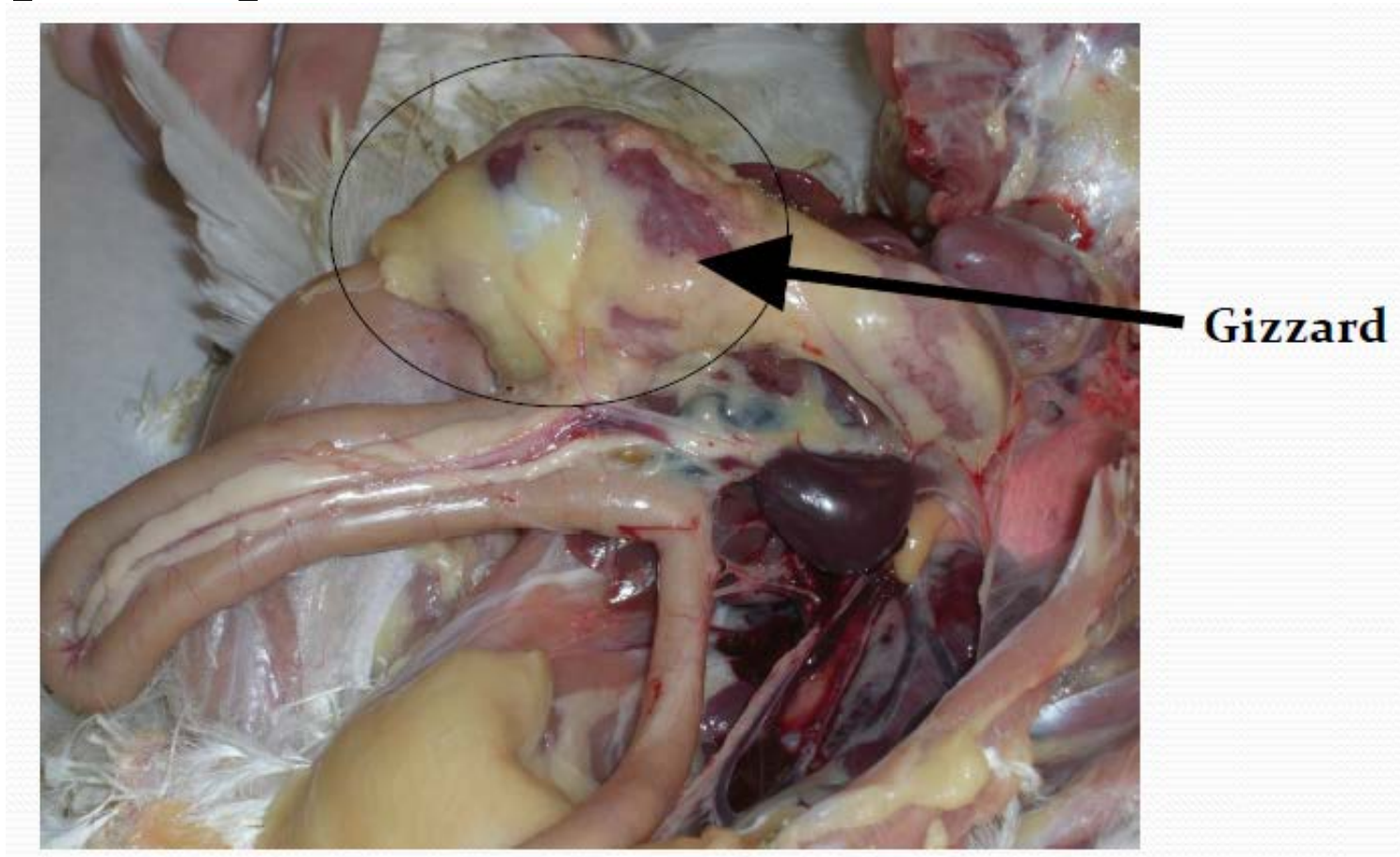


Proventriculus

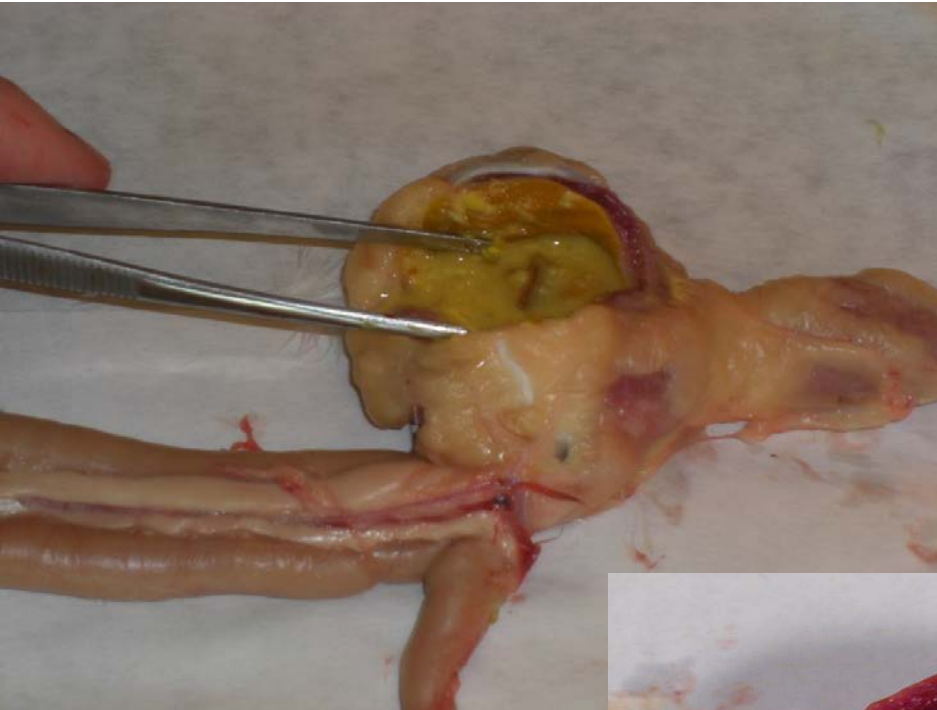
GIZZARD



- **Function:** like “teeth,” it mechanically grinds up food particles.



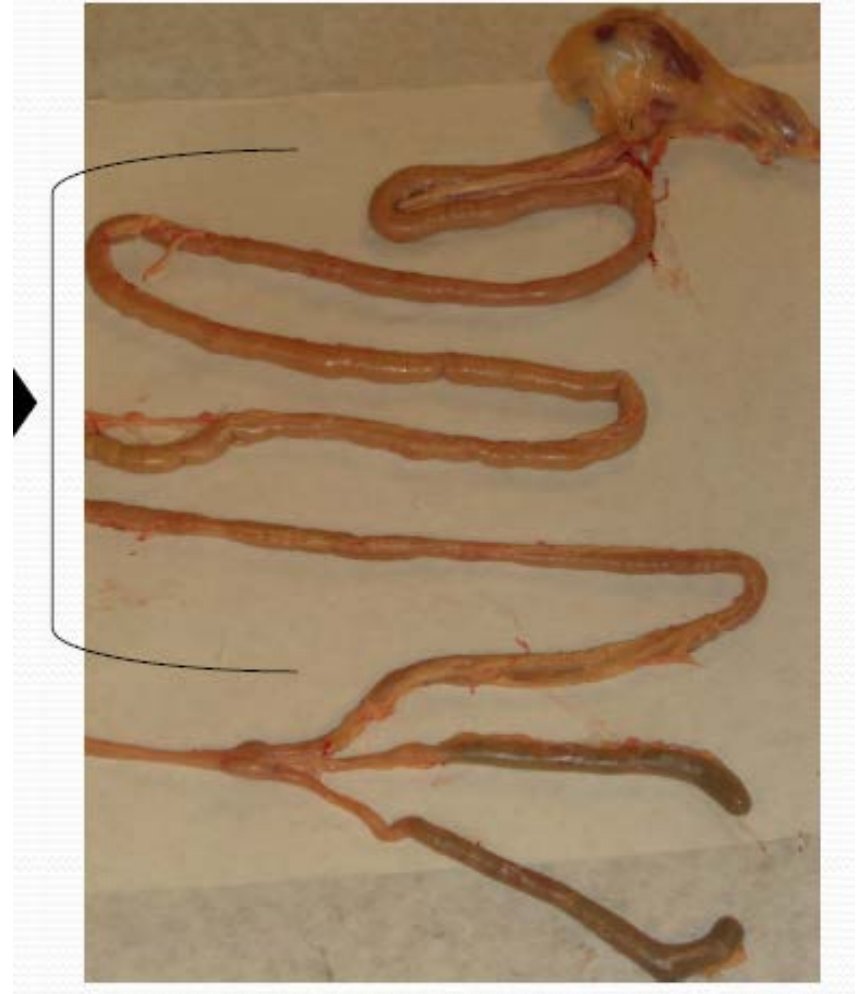
These pictures show a gizzard that has been opened. Notice how the feed inside it has been further digested.



SMALL INTESTINES

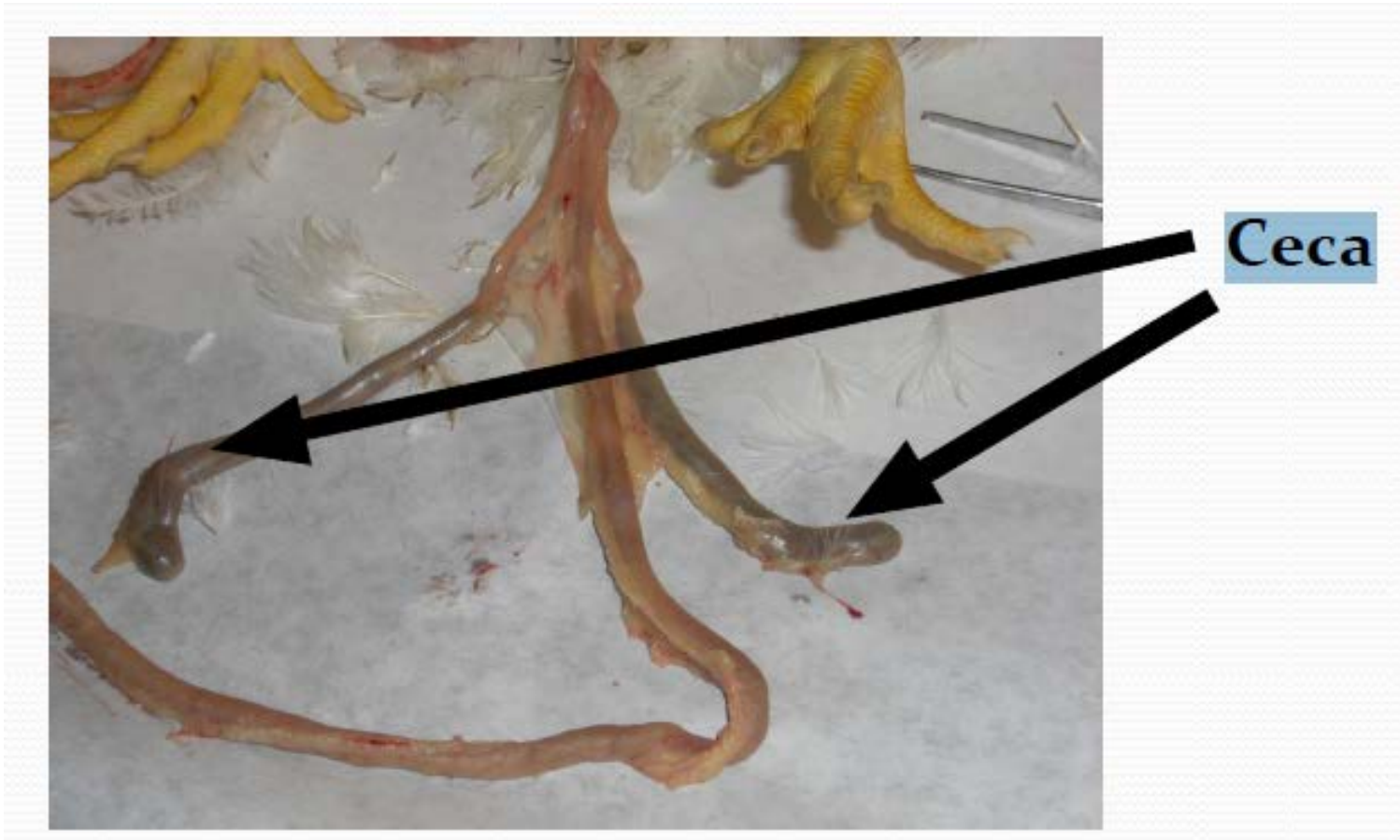
Three sections:

- Duodenum
 - Jejunum
 - Ileum
-
- Function: absorption of nutrients from food.
 - The remainder of the digestion occurs in the duodenum, and the released nutrients are absorbed mainly in the lower small intestine (Jejunum and Ileum)



CECA

- Two ceca that are terminal pouches.
 - Function: fermentation of any left over food particles/water absorption.



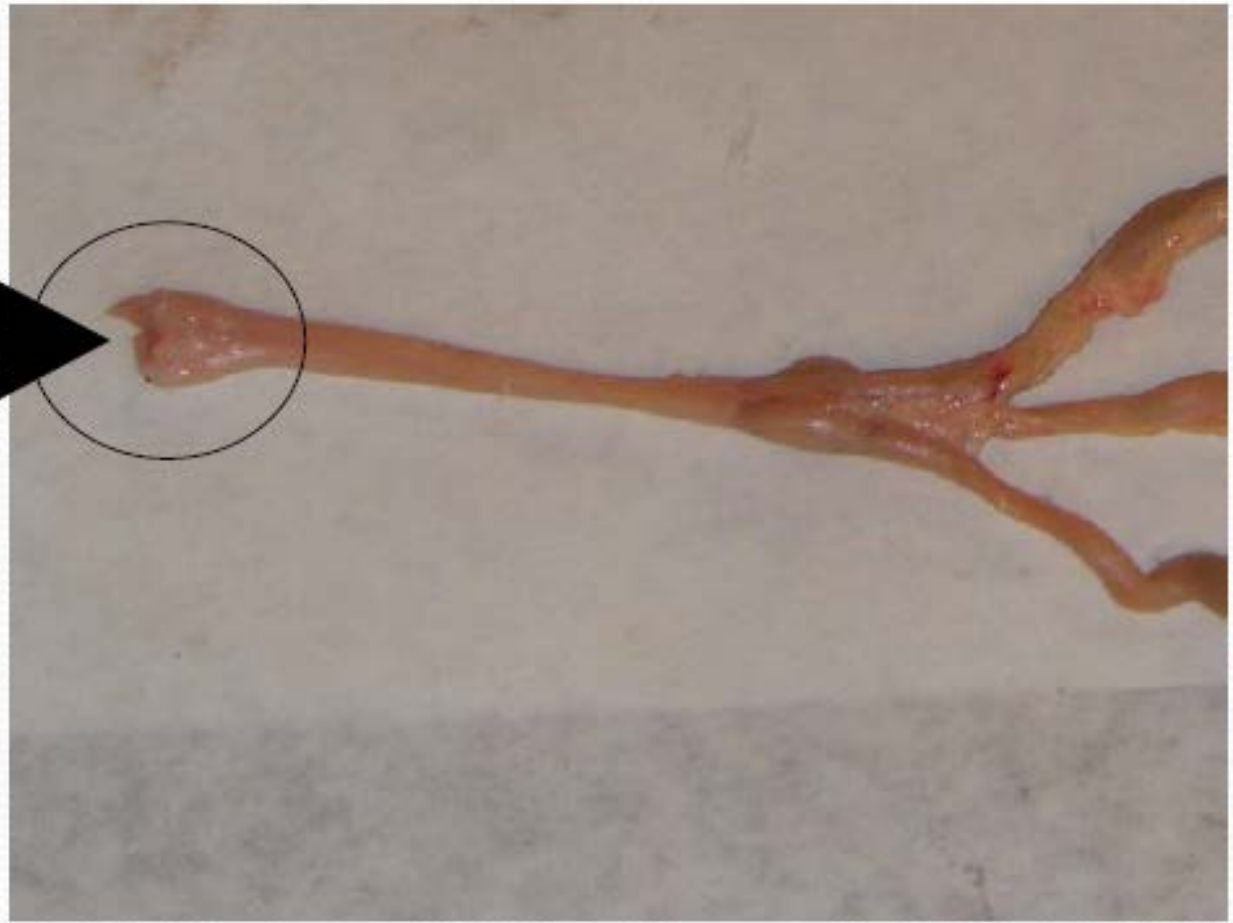
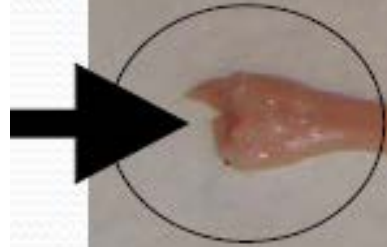
COLON

- A.K.A. Large intestine
- Function: Further water reabsorption

Large Intestine



CLOACA



- Also known as the vestibule.
- Function: responsible for expulsion of feces and urine through the vent.

Digestion

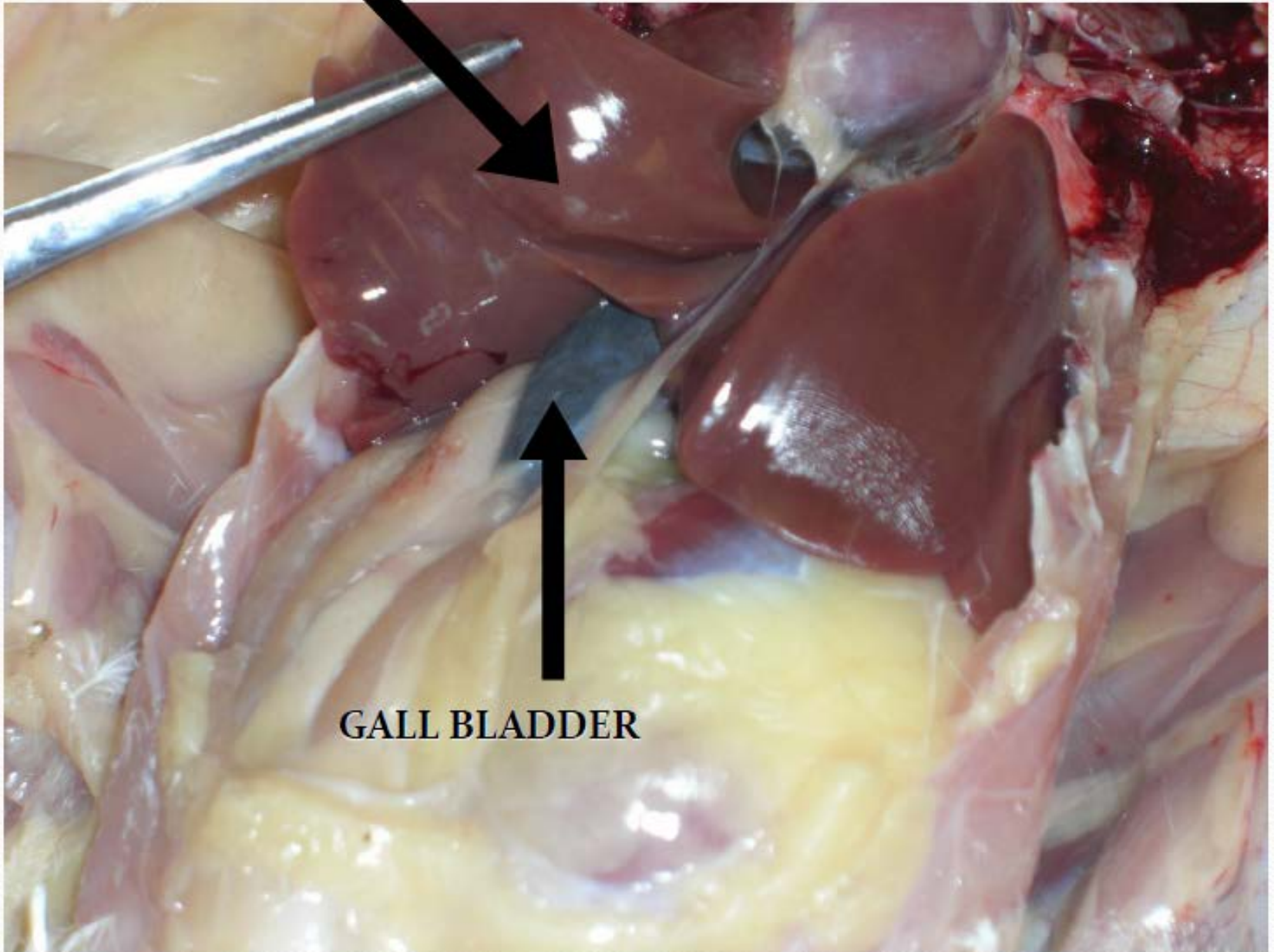


LIVER

- Multi-lobed organ
 - Functions:
 - produce bile to digest fats (stored in gall bladder).
 - detoxification
 - store fat and fat-soluble vitamins (i.e., A,D,E, K)
 - metabolize fats, carbohydrates, and proteins that are in the diet.



LIVER

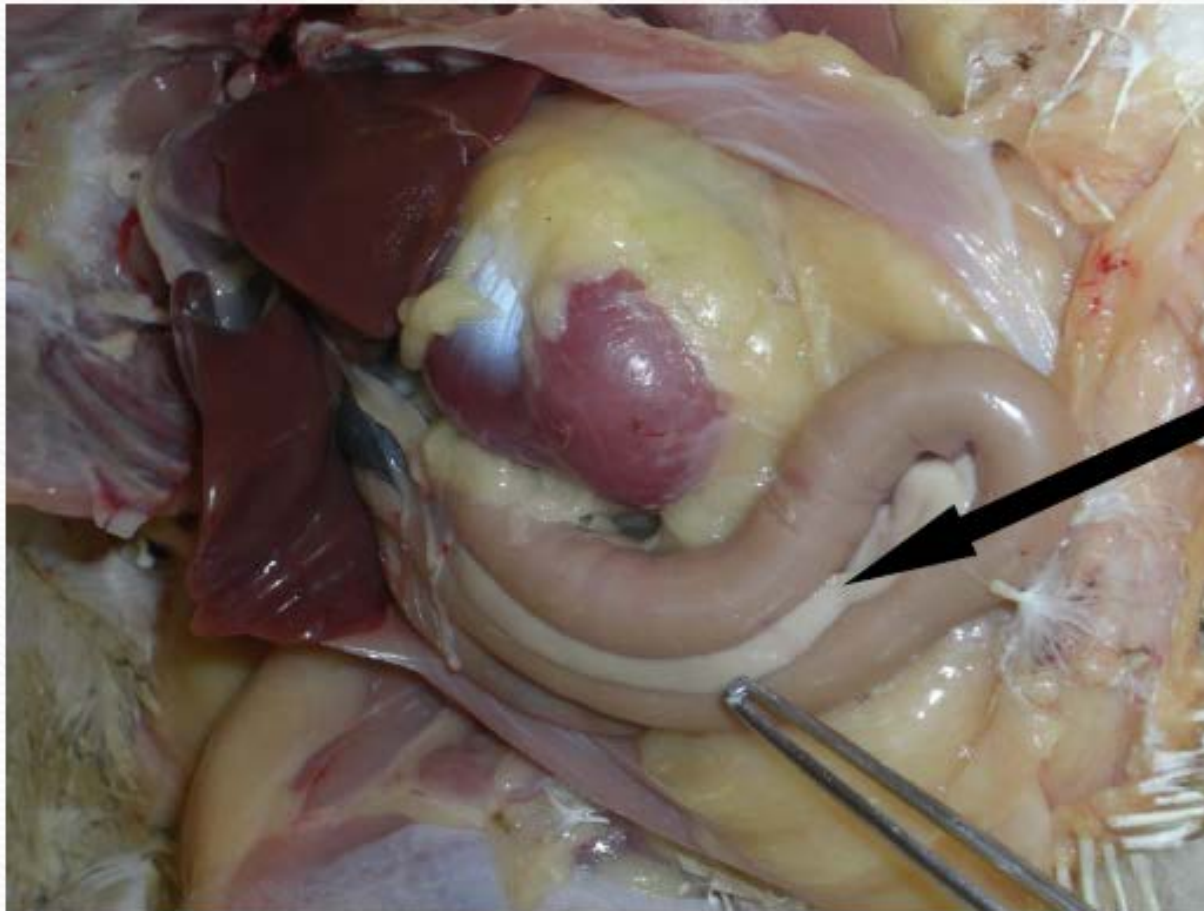


GALL BLADDER



PANCREAS

- **Function:** Produces insulin, useful in carbohydrate digestion.



Pancreas



POULTRY NUTRITION AND FEEDING



CARBOHYDRATES AND FATS (ENERGY)

- Energy is needed for
 - Muscular activity, movement, and keeping warm
 - Biochemical energy for maintenance and growth of tissue
- Glucose is metabolized and energy (ATP) is released
- Energy expressed as calories
- Most of feed intake is for calories (about 80% of the diet)
- Carbohydrates
 - Sugar, starches
 - Indigestible fiber (cellulose) not used
- Fats (lipids) are needed for
 - Help make cell membranes
 - Absorb the fat-soluble vitamins A, D, E, and K.
 - Increase palatability



ENERGY SOURCES



- **Cereal Grains**

- Corn (maize): world's most important feed grain
- Wheat
- Barley, oats
- Sorghums (milo): tannins
- Millet (pearl millet, foxtail millet, proso millet)
- Rice



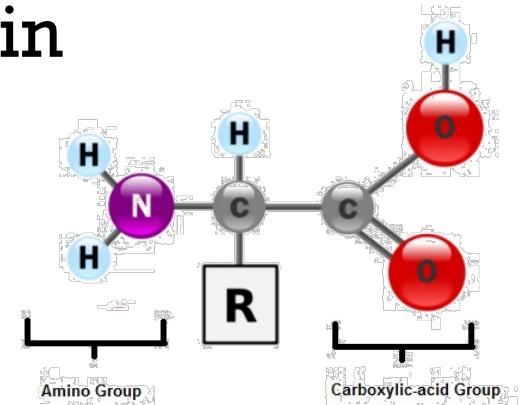
FAT SOURCES

- Examples of saturated fats
 - Tallow, lard, poultry fat, yellow/white grease
 - Corn oil, soy oil and canola oil
 - Depends on price of commodity



PROTEIN

- Muscle tissue (meat) is protein
- Amino acids
 - Building blocks of protein; protein synthesis
- Essential amino acids
 - Can't be made by chicken
 - Must be in the diet
- About 20% of diet needs to be protein



PROTEIN SOURCES

- Legumes

- Soybeans or soybean meal (cooked or heat-treated)
- Peanut meal



- Sunflower, safflower, sesame meals



- Field peas, beans (navy, lima, fava)



COMMERCIAL FEEDS

- Complete balance for bird
- Feed comes in three forms: crumbles, pellets, and mash
- From a reliable feed store it have all the nutrients in the right proportions needed
 - A balanced diet is necessary for optimal growth and production
- Don't count on name brands, check the label
- Do not supplement with scratch grains and food waste too often



ALTERNATIVE FEEDS

- Make use of local feed resources
- Scavenge-able Feed Resource Base
 - Table scraps, harvest wastes
- Efficient waste disposal system
 - Should not be more than 20% of the diet!
- Forage
 - Seeds
 - Green fodder
 - Legume plants, tree legumes



HOW MUCH

- Laying Hens: 1.5 lbs. per bird per week
 - *About $\frac{1}{4}$ lb. a day*
- Turkeys: 4 - 5 lbs. per bird per week
- Geese: 3 lbs. per bird per week
- Gamebirds: 1 - 1.5 lbs. per bird per week



QUALITY ASSURANCE

- Moldy feed is a concern
- Weed seeds
- Variability
 - Not consistent



WATER

- Chickens are 85% water (people are around 60%)
- Death in one day without water in hot weather
- Water should be clean and cool
- 100 broilers drink 7.6 gallons on a 70F day
- 100 broilers drink 12.5 gallons on a 90F day



FACTORS AFFECTING THE NUTRIENT REQUIREMENTS

- **Genetics**
 - Different species, breeds or strains of birds have different average body sizes, growth rates and production levels and will absorb and utilize nutrients from feed with different levels of efficiency
- **Age**
 - Requirements vary based on weight and stage of maturity
- **Sex**
 - After sexual maturity is reached, different formulations required
- **Reproductive State**
 - the level of egg production in hens and sexual activity in males will affect nutrient requirements
- **Ambient Temperature**
 - Feed intake increases in cold and decreases in heat
- **Housing System**
 - May effect level of activity
- **Health**
 - Disease with change requirements, especially vitamins
- **Production Aims**
 - optimizing weight gain or carcass composition, egg numbers or egg size



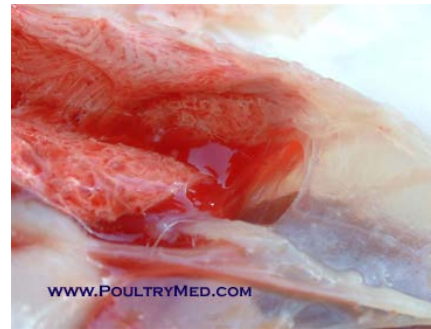
NON-COMMERCIAL FEEDS

- Ideally work with a nutritionist
- Make sure all the dietary needs are met
- Can be pricey
- Control what birds are given, especially for organic purposes



NUTRITIONAL DEFICIENCY DISEASES

Deficiency	Symptom
Riboflavin	Curled toe paralysis
Niacin	Slipped tendon (perosis)
Calcium or Phosphorus	Rickets, soft egg shells
Iron	Anemia
Iodine	Goiter



SUMMARY



- Birds differ from people
 - Crop & gizzard, need grit to grind food
 - Waste is only solid
- Check labels to get best formula for birds
 - Layers, protein
 - Chick starter 20-22%, Pullet Grower 14-16%, Layer 15-18%,
 - Broiler protein
 - Chick starter 20-24%, finisher 16-20%
 - All Purpose 16%
- Clean mold free feed and fresh water
- Don't supplement too many "goodies"
- Nutrient Deficiencies
 - Crop Impaction, soft egg shells, Perosis, Anemia
 - Increase in illnesses (vitamins)
- Know what your healthy birds look like and how they act



DON'T BE CHICKEN... ☺



Questions??

