

Unit B: Anatomy and Physiology of Poultry

Lesson1: Internal Anatomy of Poultry

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Identify the parts of the digestive system of poultry.
2. Identify the parts of the poultry circulatory system.
3. Identify the parts of the poultry respiratory system.
4. Identify the parts of the poultry reproductive system.
5. Identify parts of the poultry urinary system.
6. Identify parts of the poultry lymphatic system.

Recommended Teaching Time: 4hours

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed for use with this lesson plan
- <http://people.eku.edu/ritchisong/birdrespiration.html>
- <http://people.eku.edu/ritchisong/birdcirculatory.html>
- <http://people.eku.edu/ritchisong/birddigestion.html>
- <http://www.poultryhub.org/index.php/Reproduction>
- http://www.fsis.usda.gov/PDF/PSIT_Anatomy.pdf
- http://www.poultryhub.org/index.php/Anatomy_of_the_Chicken_Learning_Resource

List of Equipment, Tools, Supplies, and Facilities

Writing surface

PowerPoint Projector

PowerPoint Slides

Transparency Master copies

Student worksheet copies

Crayons, colored pencils, or markers (optional but encouraged)

Poultry to dissect or examples of the systems

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint

Slide # 2):

abdominal air sacs	lungs
air sacs	muscular stomach
bursa of Fabricius	ovary
cervical	oviduct
cloaca	pancreas
colon	pericardial sac
coronary band	proventriculus
crop	rectum
diverticula	spleen
duodenum	syrix
esophagus	testicle
gizzard	thymus
glandular stomach	thoracic
gozzle	trachea
gullet	true stomach
ileum	ureters
interclavicular air sac	uric acid
jejunum	vent
kidneys	ventriculus
liver	windpipe

Interest Approach: Use an interest approach that will prepare the students for the lesson.

Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Ask the students, “Why is it important that we study the internal anatomy of poultry?” Let the students discuss this as a class. Once they have provided their ideas fill in the missing points such as being able to: diagnose diseases, determine proper rations, and give appropriate medications. Use this discussion to transition into Objective 1.

Summary of Content and Teaching Strategies

Objective 1: Identify the parts of the digestive system of poultry.

(PowerPoint Slide #3)

- I. The digestive tract of the bird begins with the mouth, which does not contain lips or teeth.
 - A. As in mammals, the mouth is connected to the **esophagus**, also called the **gozzle** or **gullet**.

(PowerPoint Slide #4)

- B. In chickens the distal end of the esophagus has a specialized area for the storage of feed called the **crop**.
 1. The **crop** is located at the base of the neck as it is viewed externally.

(PowerPoint Slide #5)

- C. Following the crop is another short section of esophagus ending in the stomach.
 1. In birds the stomach consists of two parts.
 2. The **proventriculus**, also called the **glandular stomach** or **true stomach**, is located near the end of the crop.
 - a. It secretes hydrochloric acid and pepsin, which are used to aid in protein digestion.

(PowerPoint Slide #6)

3. The **ventriculus**, also called the **gizzard** or the **muscular stomach**, is near the end of the proventriculus, and is much larger and more muscular in appearance when compared to the proventriculus.
 - a. The major function of the ventriculus is to grind the food.
 - b. This grinding action prepares the food for digestion.

(PowerPoint Slide #7) This slide shows where the proventriculus and ventriculus are located in the digestive tract of a chicken.

(PowerPoint Slide #8)

- D. The ventriculus empties into the small intestine, which consists of the **duodenum**, the **jejunum**, and the **ileum**.
 1. The duodenal portion is the most cranial, and is significant because the **pancreas** is located in the duodenal loop.
 2. The secretions of the pancreas contain enzymes, which enter the duodenum through the pancreatic ducts.

(PowerPoint Slide #9) This slide shows where the duodenum, jejunum and ileum are located in the chicken's digestive tract.

(PowerPoint Slide #10)

- E. The large intestine consists of a pair of ceca and a short straight intestine, called the **colon** or **rectum**.
 1. This section of large intestine is similar to the rectum of mammals.

(PowerPoint Slide #11) This slide shows a diagram of the location of the colon and the cecum in the bird's digestive tract.

(PowerPoint Slide #12)

- F. The **cloaca** is the termination of the digestive system.
 1. This portion of the digestive system represents a common passage for digestive, urinary, and reproductive systems.
 2. The cloaca opens externally in what is called the **vent**.

(PowerPoint Slide #13) This slide shows the location of the cloaca or vent.

(PowerPoint Slide #14)

- G. The **bursa of Fabricius** is located as a diverticulum in the dorsal wall of the cloaca.
 1. This bursa contains lymphatic tissue and has a function related to immunity and antibody production.
 2. It regresses in size and disappears as the bird matures.
 3. It appears as a small sac on the side of the cloaca.

(PowerPoint Slide #15) This is a real-life picture of the bursa of Fabricius. Notice the size. It is roughly 3.5 centimeters. As the bird matures, the bursa of Fabricius will shrink. This is how bird age can be determined.

(PowerPoint Slide #16)

- H. Birds that are healthy and well-nourished will usually deposit substantial amount of fat throughout their tissues.
 1. The abdominal area and vent flaps are major fat depots, as are the areas surrounding the **gizzard** and the **coronary band** of the heart.
 2. There may be considerable variation in the color of poultry fat.
 3. Diet, age, health status, and breed are all factors that can influence this color

(PowerPoint Slide #17)

- I. The normal liver is a single organ which has two lobes.
 1. The color varies somewhat depending on the fat content.
 2. Each lobe of the liver is drained by a bile duct.
 3. The duct from the right lobe is enlarged to form the gallbladder.
 4. Both ducts enter the small intestine together.

(PowerPoint Slide #18) This slide shows a picture of a bird liver.

(PowerPoint Slide #19) This slide is a drawing showing the located of the liver in a chicken.

Dissect a bird and identify the parts of the digestive system. Show TM: B1-1 as an illustration of the digestive tract. Have the students complete WS: B1-1 by labeling the parts of the digestive tract. Provide crayons, colored pencils, or markers so they can color the parts. Coloring the parts will aid in memorization of the parts.

Objective 2: Identify the parts of the poultry circulatory system.

(PowerPoint Slide #20)

- II. The parts of the circulatory system includes all organs that move, filter and produce blood and are as follows:

(PowerPoint Slide #21)

- A. The heart of the chicken is four-chambered, like those of mammals, and beats at a rate of 250 beats per minute for larger breeds and up to around 350 beats per minute for smaller breeds.
 1. In contrast, the heart rate for human beings is typically around 80 beats per minute.

(PowerPoint Slide #22)

- B. The deep body temperature of a chicken is around 41 degrees C, versus that of mammals which is typically between 36.6 and 38.8 degrees C.
- C. Avian red blood cells, or erythrocytes, are nucleated, whereas mammalian red blood cells are not.

(PowerPoint Slide #23)

- D. Some points to remember about the heart are that the heart's **coronary band** (around the top portion) has a normal fat structure that may show changes in quantity and appearance when a systemic disease occurs.

(PowerPoint Slide #24)

- E. Other points to remember are that the **pericardial sac** is the thin membrane that encloses the heart, and that the heart normally has a small deposit of fat at the tip as well as around the coronary band.

(PowerPoint Slide #25) This slide shows a picture of a bird heart. Notice the fatty deposits around the coronary band.

Dissect a bird to find the heart and have the students observe it. Show TM: B1-2 which shows the chambers of a chicken heart. Ask the students how they think a bird heart differs from a human heart. Provide copies of WS: B1-2 and have the students label the parts of the avian heart.

Objective 3: Identify the parts of the poultry respiratory system.

(PowerPoint Slide #26)

- III. The respiratory system of birds is more complex than the mammalian counterpart.
- A. For our purposes, the respiratory system in the bird is comprised of the **trachea, syrinx, lungs, and air sacs**.

(PowerPoint Slide #27)

- B. The **trachea**, or **windpipe**, is the structure through which air enters the bird, and has cartilaginous rings along its length.

(PowerPoint Slide #28) This slide shows a picture of a trachea in a bird. Notice the rings along its length.

(PowerPoint Slide #29)

- C. The **syrinx** is located where the trachea bifurcates (splits into two separate branches), and is similar to the larynx (voice box) of mammals.
 1. Air passes through the trachea and at the terminal portions of the trachea the air sac structures bud out.
 2. These are very thin, colorless membranes that, when inflated with air, resemble tiny balloons inside the body cavity.

(PowerPoint Slide #30) This slide shows the syrinx in a bird.

(PowerPoint Slide #31)

- D. The function of the lungs is to facilitate gas exchange, as it is in mammals.
 1. However, because avians have air sacs, air flows through avian lungs on both inspiration and expiration.
 2. As well as functioning in respiration, air sacs may also regulate intrabody pressure and body temperature.

(PowerPoint Slide #32)

- E. The number of air sacs varies in different species.
 1. The most anterior air sac is the **cervical**.
 - a. It lies, as the name implies, in the neck area and is not observed during postmortem inspection.

(PowerPoint Slide #33)

2. The next air sac, moving in a caudal direction, is the **interclavicular air sac**.
 - a. Some information to remember about this particular air sac is that it lies between the clavicles (as the name implies), is the most anterior air sac observed on postmortem inspection, and has communication with other tissues, including bone, through **diverticula** (tiny fingerlike projections).

(PowerPoint Slide #34)

3. The **thoracic** air sacs are next and lie in the rib cage area.
 - a. In chickens and ducks there are two pairs- anterior and posterior- whereas the turkey only has one pair of thoracic air sacs.
 - b. The **abdominal air sacs** are paired and are located in the abdominal part of the body cavity.

(PowerPoint Slide #35) This slide shows the location of the various air sacs found in birds.

Dissect a bird to find the parts of its respiratory system. Show TM: B1-3 which is a diagram of a bird's respiratory system. Ask the students to compare a bird's respiratory system to that of humans. Provide the students with a copy of WS: B1-3 and have them label the parts of the avian respiratory system.

Objective 4: Identify the parts of the poultry reproductive system.

(PowerPoint Slide #36)

- IV. The reproductive parts of poultry differ between male and female.
 - A. The female reproductive system consists of the left **ovary** and **oviduct**.
 - 1. Although present in the embryo, the right ovary and oviduct fail to develop.
 - 2. The oviduct terminates in the cloaca.

(PowerPoint Slide #37) Here is a diagram of a female poultry reproductive tract. This will be covered more in depth in the egg production lesson.

(PowerPoint Slide #38)

- B. The male reproductive system consists of two **testicles**, which secrete semen through a vas deferens.
 - 1. The vas deferens terminates in the cloaca.
 - 2. The chicken has a rudimentary penis.

(PowerPoint Slide #39) This slide shows a diagram of male poultry reproductive parts.

The reproductive systems will be covered more in depth in the lessons on reproduction and also egg production.

Dissect a bird of both genders to find the reproductive system. Use TM: B1-4 and B1-5 to show illustrations of the reproductive parts. Provide copies of WS: B1-4 and B1-5 and have the students label the parts of the male and female avian reproductive systems.

Objective 5: Identify parts of the poultry urinary system.

(PowerPoint Slide #40)

- V. The urinary system of the birds does not contain a urinary bladder.
 - A. There are two tri-lobed kidneys, one on each side of the ventral surface of the vertebral column.

(PowerPoint Slide #41)

- B. This pair of **kidneys** is embedded in the deep bony crypts of the pelvic and sacral area of the skeleton.

(PowerPoint Slide #42) This slide shows a picture of kidneys in a bird.

(PowerPoint Slide #43)

- C. **Ureters** carry the urinary waste to the cloaca.

(PowerPoint Slide #44)

- D. The **uric acid** is discharged into the cloaca and excreted with the feces.
- E. The white pasty material in chicken droppings is considered to be urinary system excretion.
- F. Birds excrete their nitrogen waste as uric acid, whereas mammals excrete it in the form of urea.

Have the students identify the kidneys and ureters in the dissected bird. Once the parts have been identified have the students draw them on a piece of paper in as much detail as possible. Ask the students why there is no bladder in birds.

Objective 6: Identify parts of the poultry lymphatic system.

(PowerPoint Slide #45)

- VI. The lymphatic system of chickens does not contain lymph nodes and in general is poorly developed when compared with mammals.
- A. The lymphatic system is responsible for giving immunity to the bird to protect it from sickness.

(PowerPoint Slide #)

- B. There are several organs which contain lymphatic tissue- the **bursa of Fabricius**, the **spleen**, and the **thymus**.

(PowerPoint Slide #47)

1. The **thymus** gland consists of about five pairs of pale pink, flattened, irregularly shaped lobes strung out along both sides of the neck, near the jugular veins.
 - a. The thymus decreases in size as the bird matures.

(PowerPoint Slide #48) This slide is a picture of the thymus gland. Notice the five lobes along its length.

(PowerPoint Slide #49) This is another picture of the thymus showing where it is located in the bird's body.

(PowerPoint Slide #50)

2. The **spleen** is a small, round, soft organ similar in color to the liver.
 - a. The normal spleen is about 19 millimeters in diameter, located near the ventriculus (gizzard) in the body cavity.
 - b. The functions of the spleen include phagocytosis of worn-out erythrocytes in red pulp, lymphocyte production in white pulp, and antibody production in both the red and white pulp.
3. The **bursa of Fabricius** was discussed in the digestive system.

(PowerPoint Slide #51) This slide shows the location of the spleen in a bird's body.

Explain to the students that there is no actual lymphatic system in poultry. Whereas systems like the digestive and circulatory all seem to be self-contained and follow a specific path, the lymphatic system is a number of organs spread throughout the body of the bird. Identify the parts of the bird that provide immunity and have the students draw these parts on a piece of paper in as much detail as possible.

Review/Summary: Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used to determine which objectives need to be reviewed or re-taught with a different approach. Questions on **PowerPoint Slide #52** can also be used.

Application: Have students go to the following website and read through the various sections of the poultry anatomy. This website provides real life color drawings of the systems of a chicken and will further enhance the understanding of poultry anatomy.

http://www.poultryhub.org/index.php/Anatomy_of_the_Chicken_Learning_Resource

Evaluation: Evaluation should focus on student achievement of this lesson's objectives. A sample written test is attached.

Answers to Sample Test:

Part One: Identification

1-8 answers can be found on TM: B1-1 "Poultry Digestive Tract"

9-12 answer can be found on TM: B1-3 "Poultry Respiratory Tract"

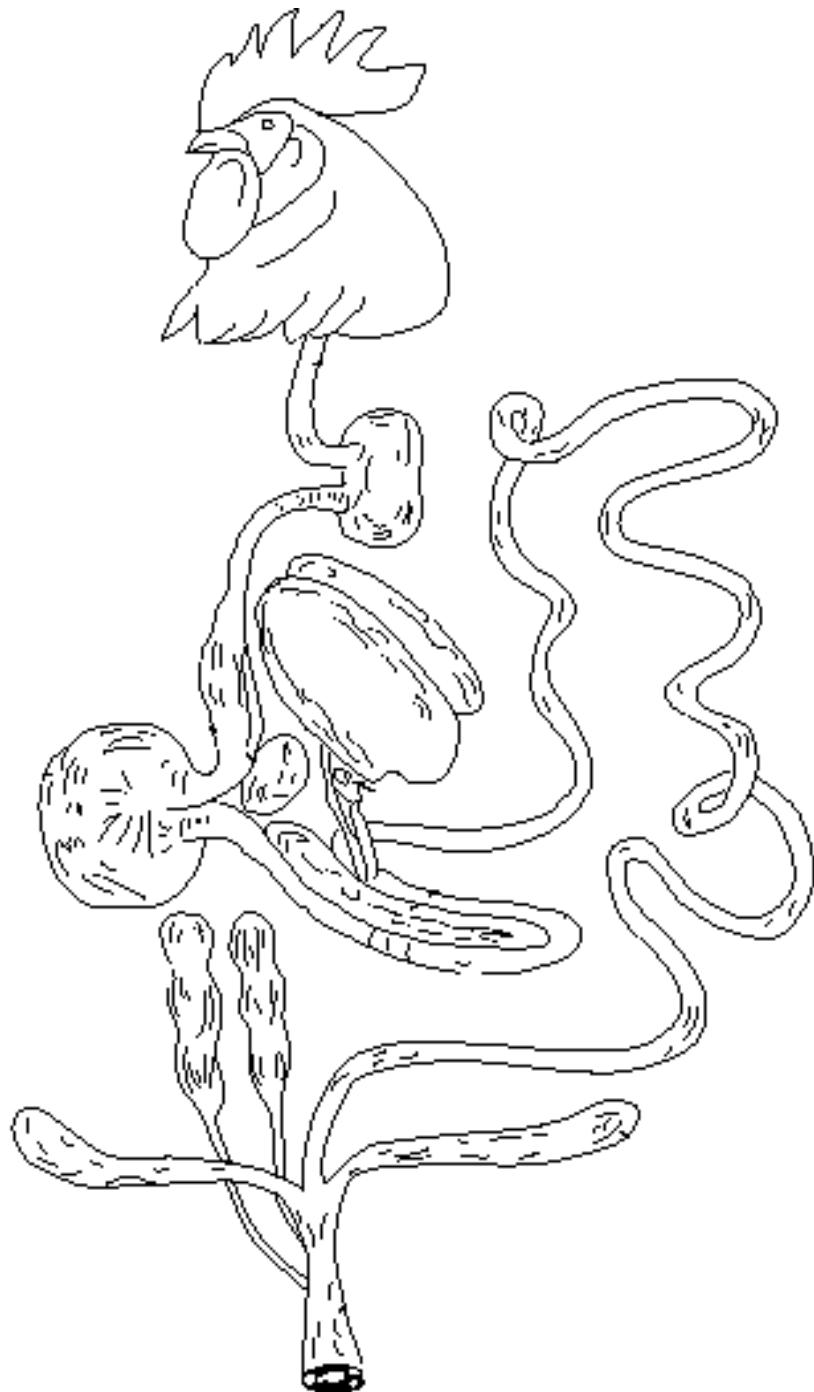
Part Two: Short Answer

13. The purpose of the circulatory system is to move, filter and produce blood.
14. Look at the fat structures around the coronary band.
15. The right ovary and oviduct are not functional.
16. Reproductive tracts terminate at the cloaca.
17. The lymphatic systems gives immunity to disease and sickness.
18. The bursa of Fabricius, spleen, thymus

Test

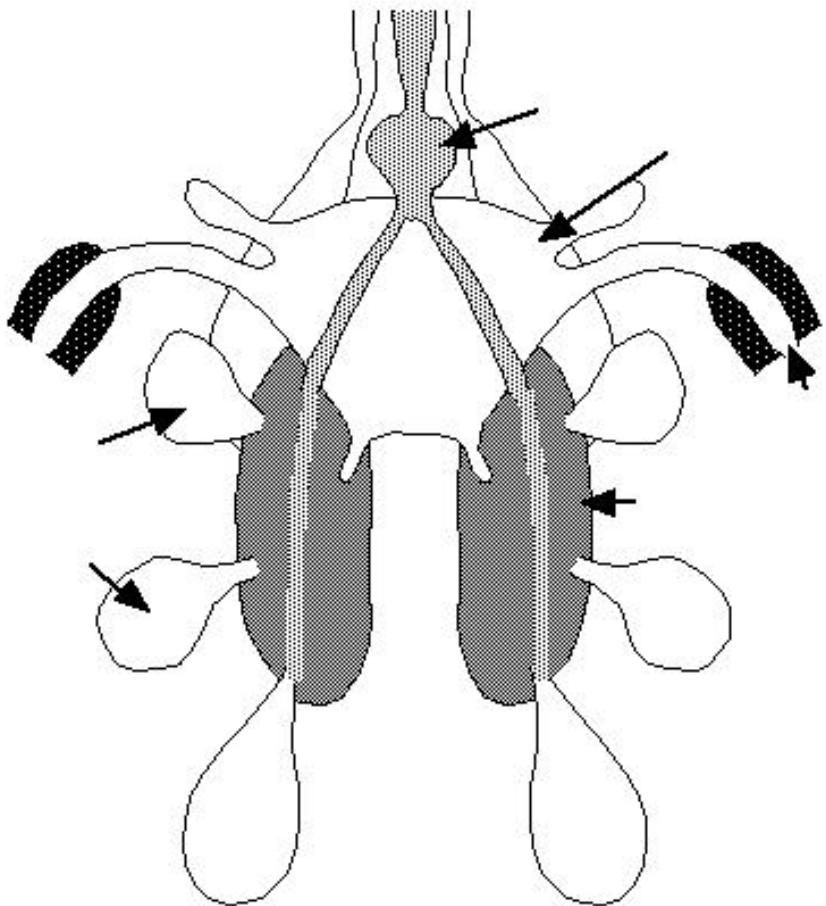
Unit B Lesson 1: Internal Anatomy of Poultry**Part One: Identification***Identify the following parts of the poultry digestive tract:*

1. Esophagus
2. Crop
3. Proventriculus
4. Ventriculus
5. Duodenum
6. Jejunum
7. Ileum
8. Cloaca(vent)



Identify the following parts on the poultry respiratory system:

9. Trachea
10. Syrinx
11. Lungs
12. Air sacs

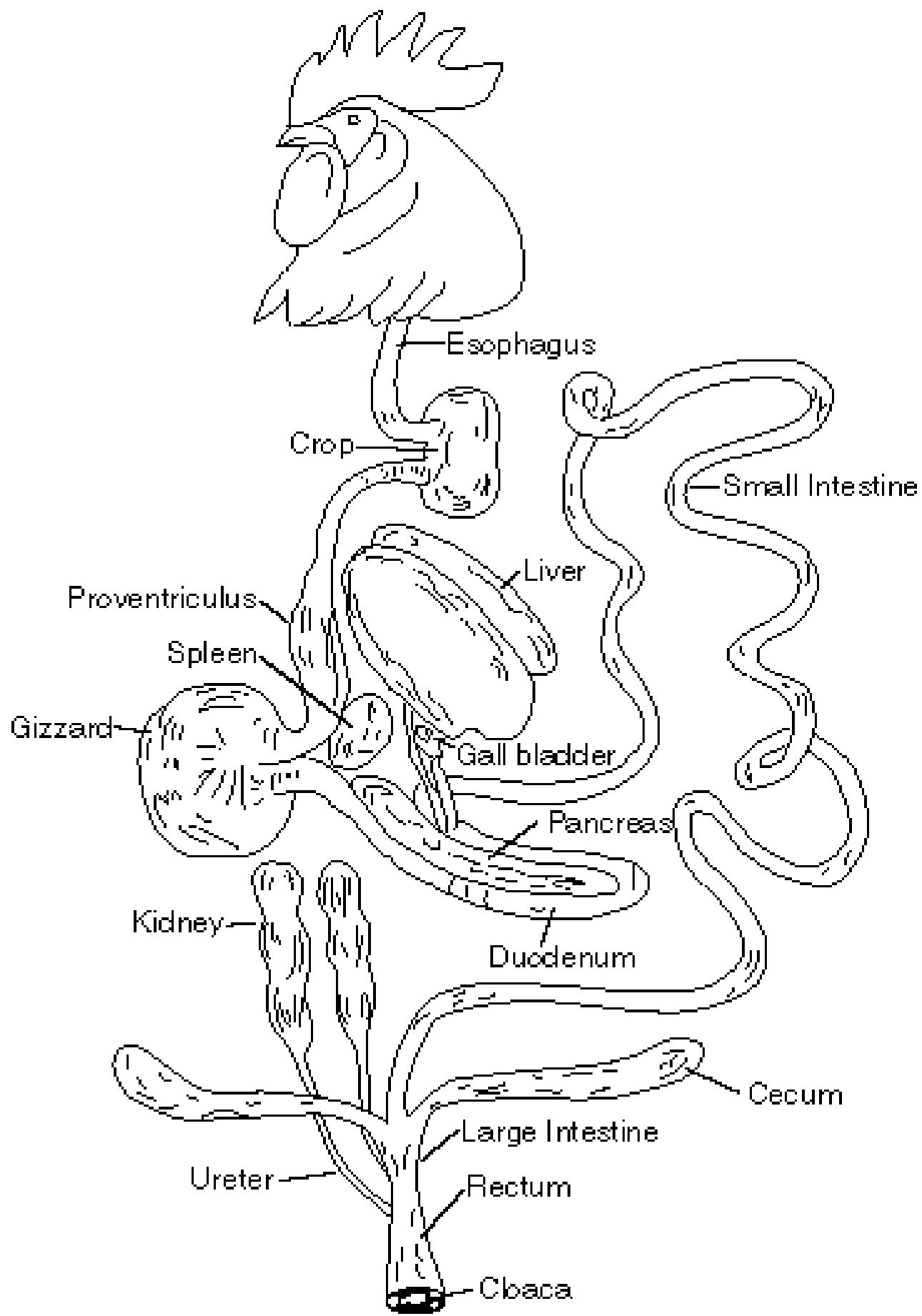


Part Two: Short Answer

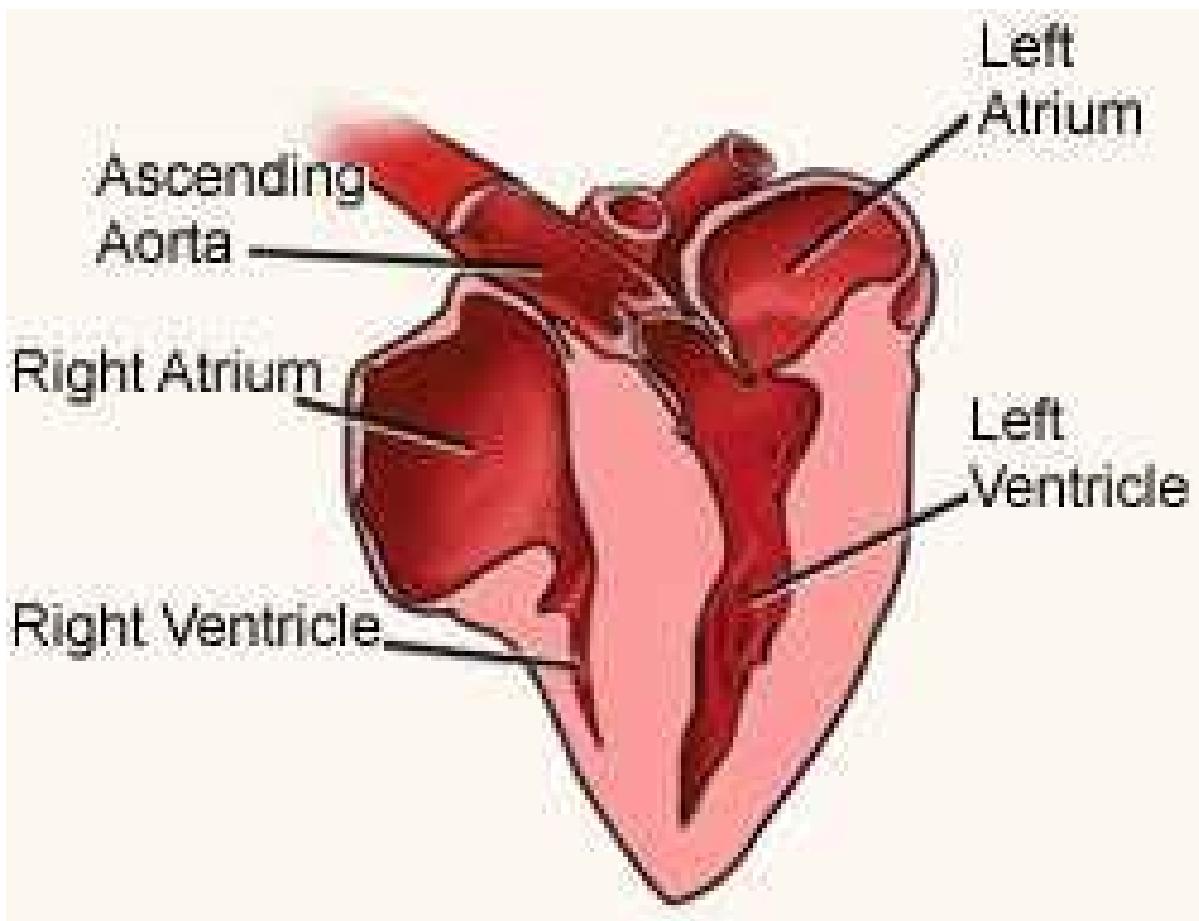
Instructions: Provide a short statement to answer the following questions.

13. What is the purpose of the circulatory system?
14. If you believe a bird has died from a systemic disease, where on the heart should you look to verify this?
15. The ovary and oviduct of which side is not functional in poultry?
16. The reproductive tracts in the male and female bird both terminate where?
17. What is the purpose of the poultry lymphatic system?
18. Which three organs contain lymphatic tissue?

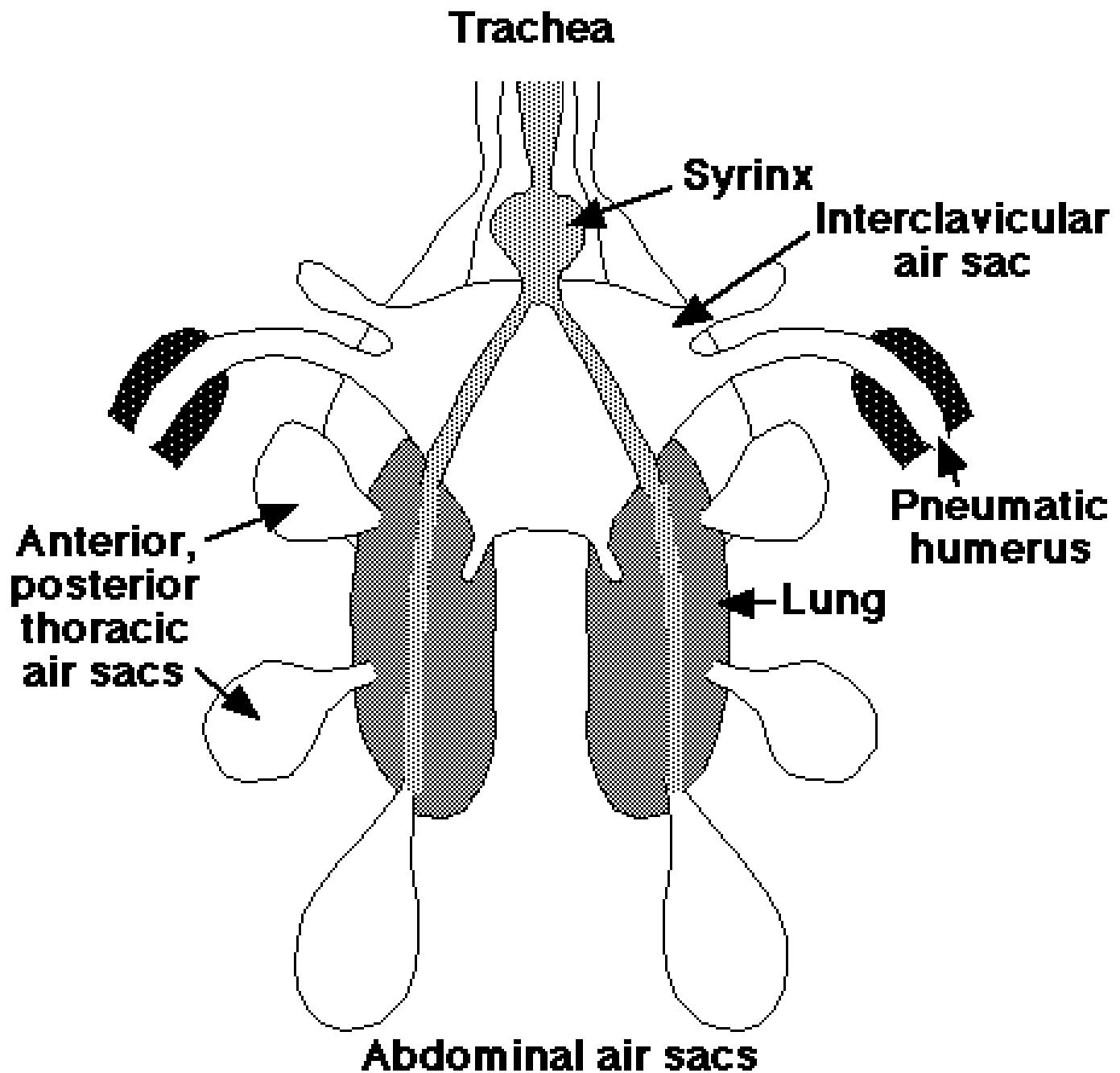
Poultry Digestive Tract



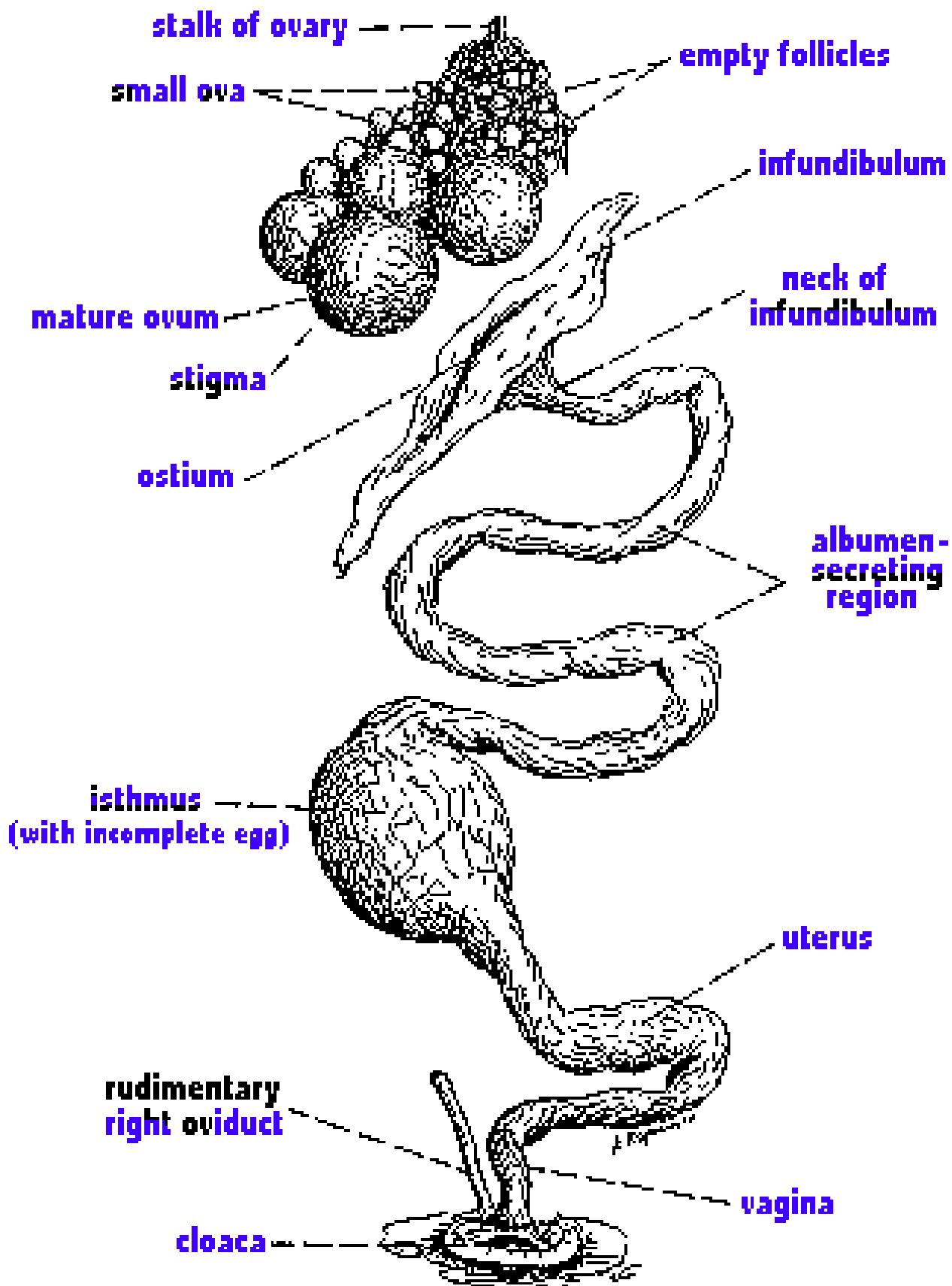
Poultry Circulatory System



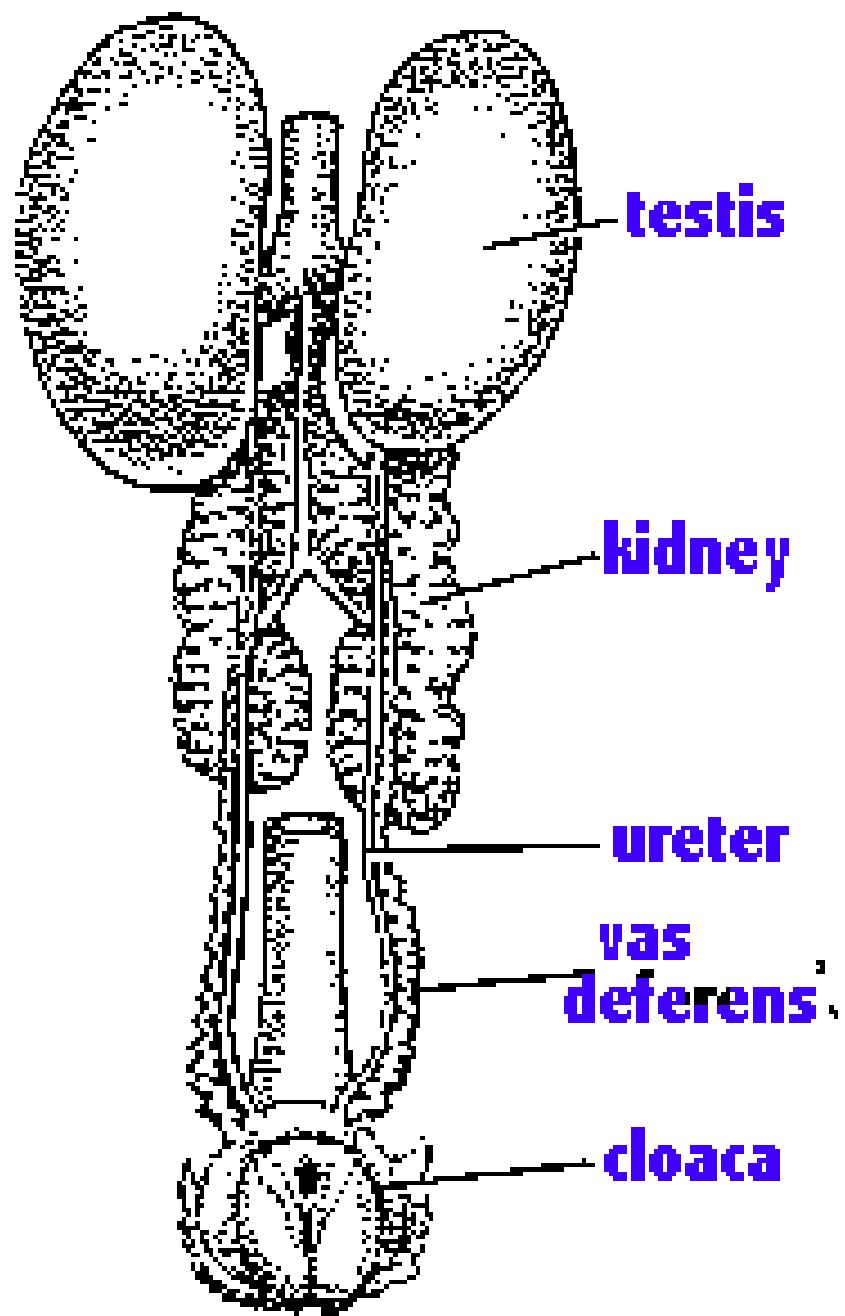
Poultry Respiratory System



Female Poultry Reproductive System

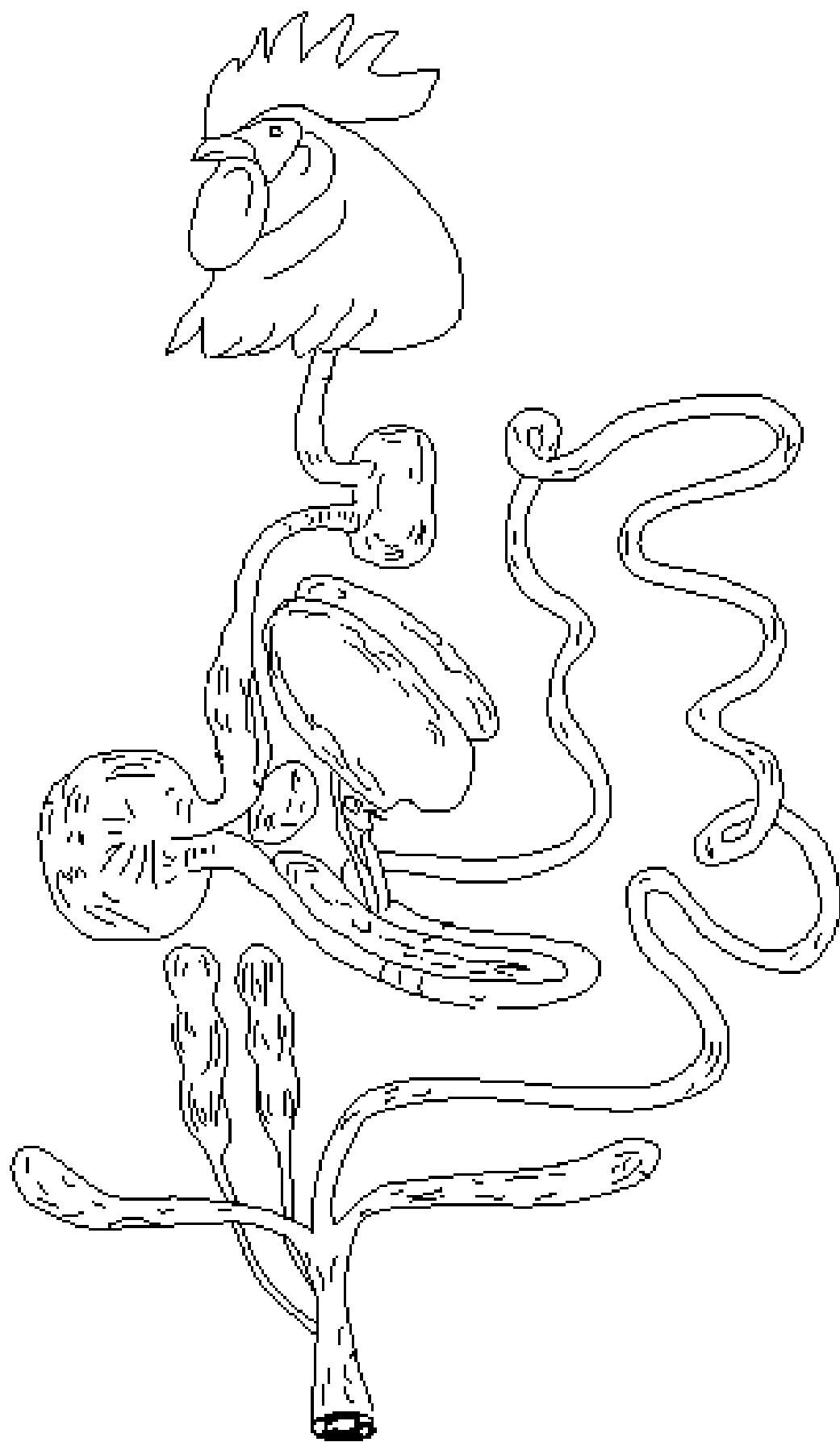


Male Poultry Reproductive System



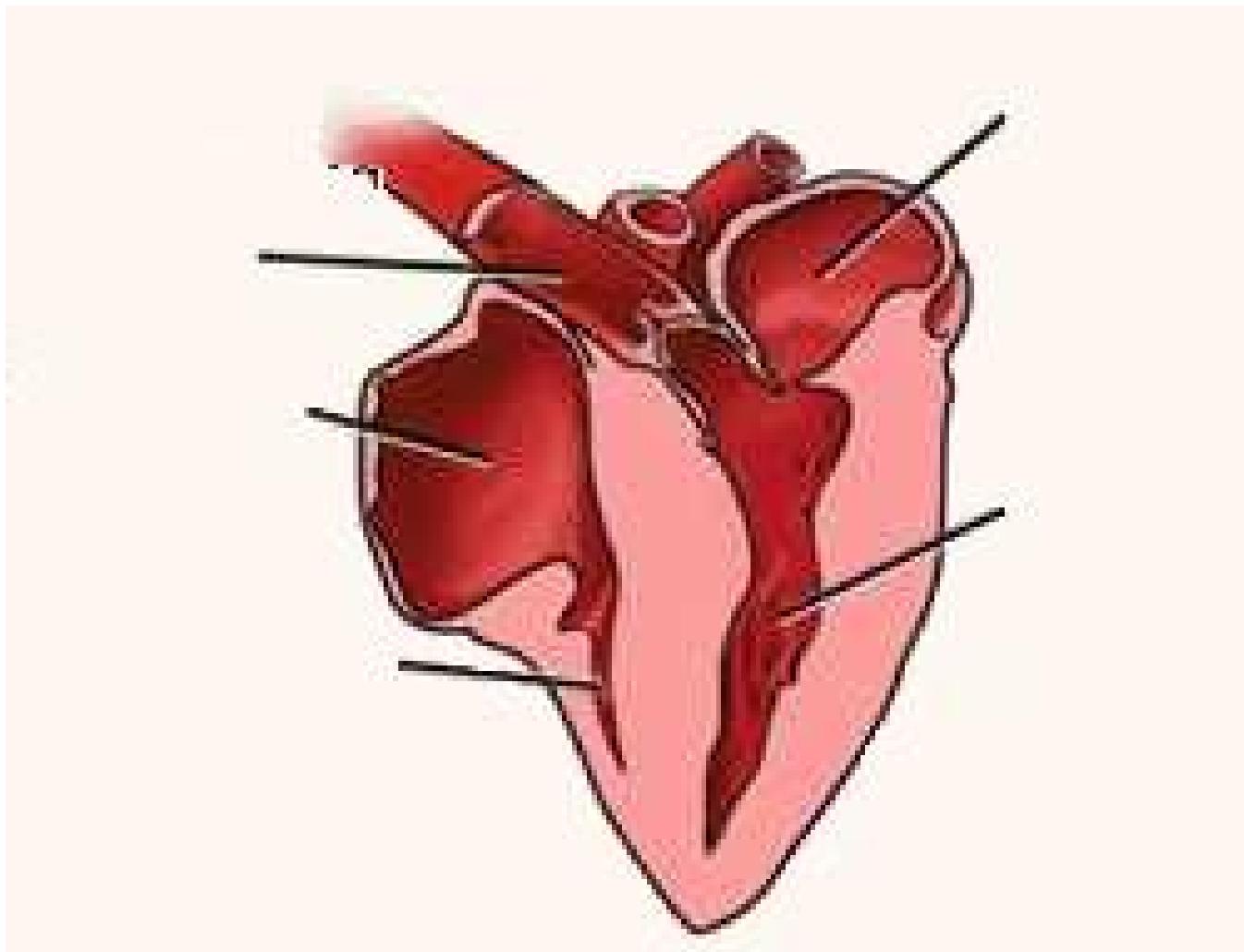
WS: B1-1

Poultry Digestive Tract



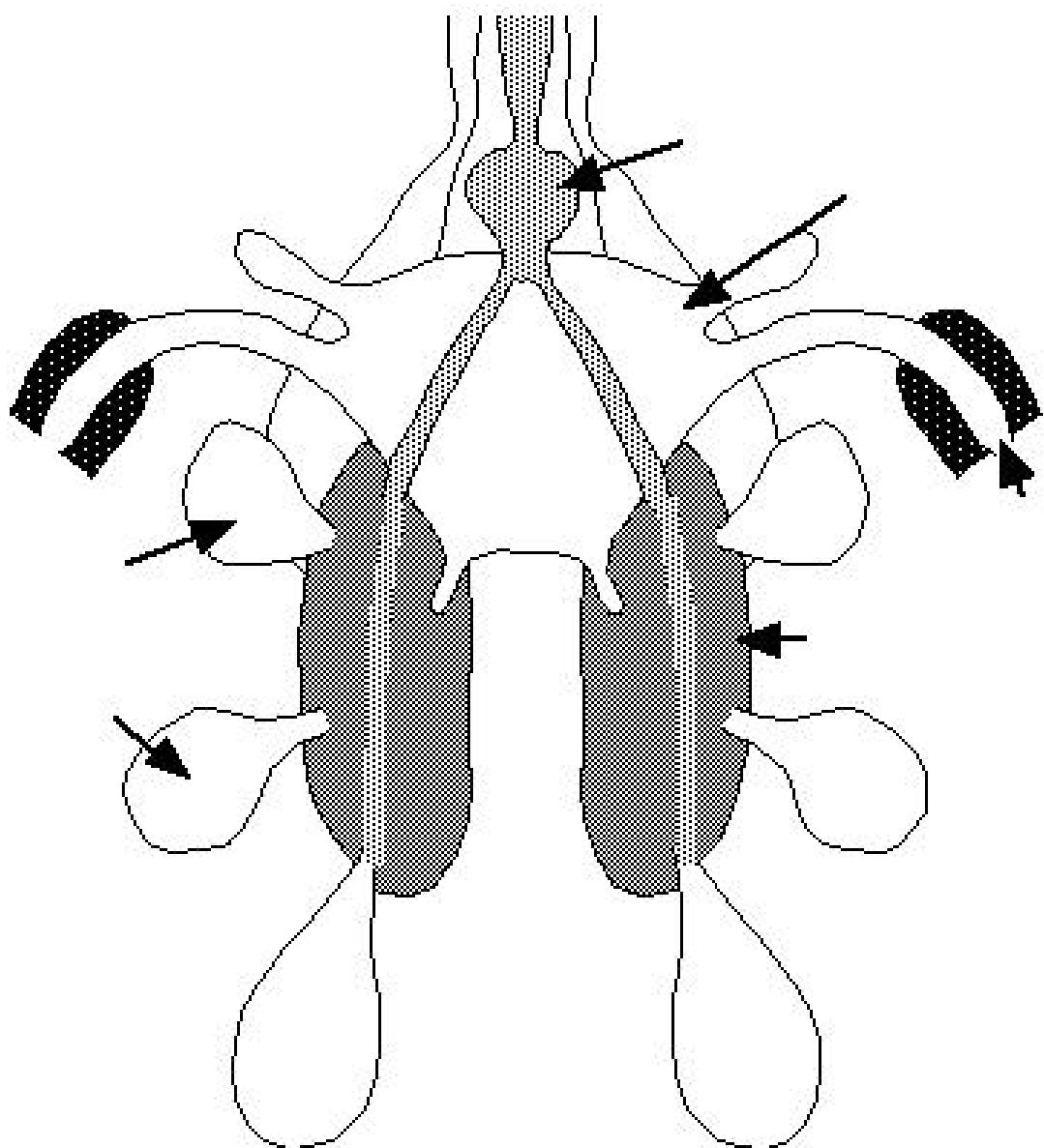
WS: B1-2

Poultry Circulatory System



Poultry Respiration System

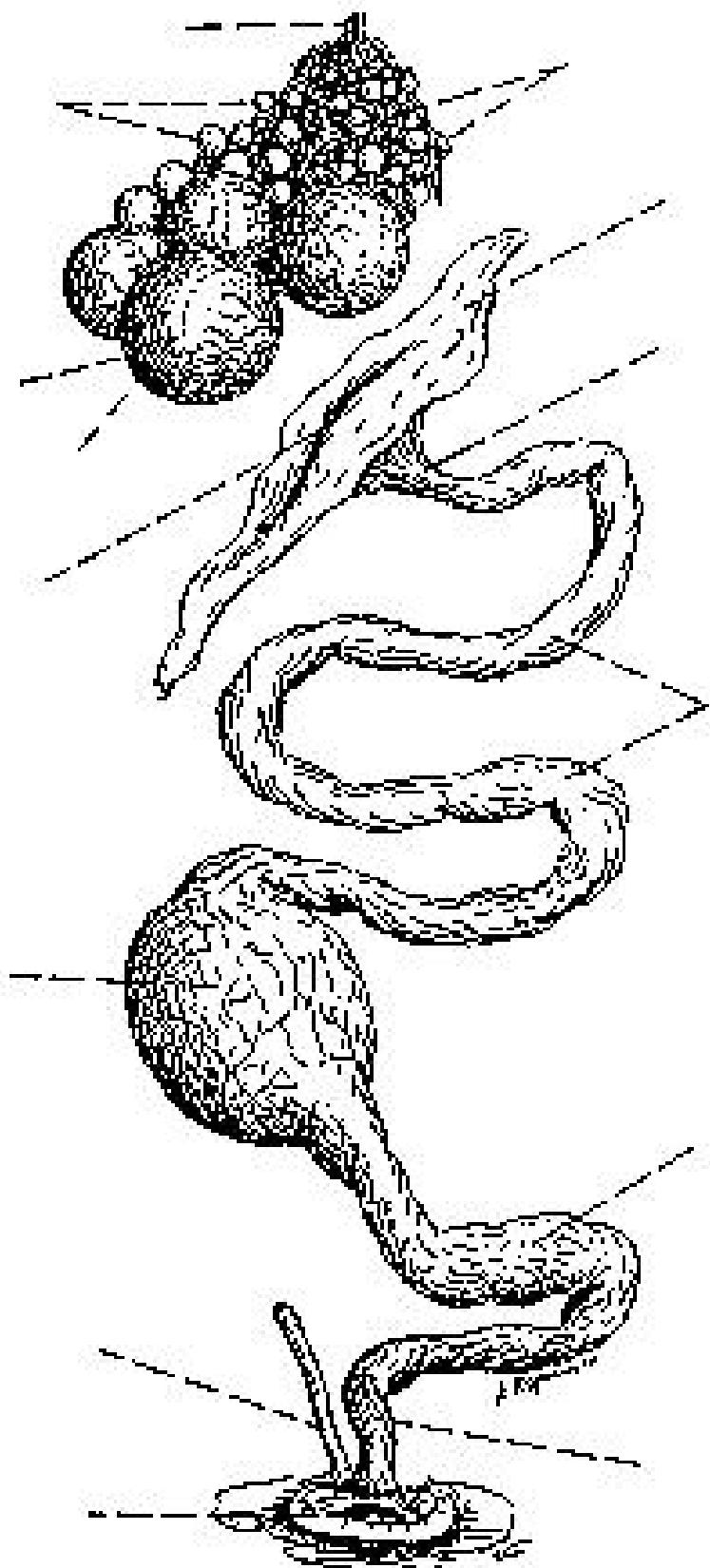
Instructions: Label the important parts of the poultry respiration system



WS: B1-4

Female Poultry Reproductive Tract

Instructions: Label the parts of the female reproductive tract.



WS: B1-5**Male Poultry Reproductive Tract**

Instructions: Label the parts of the male poultry reproductive tract.

