

Lesson B4–1

Anatomy and Physiology of Animal Reproductive Systems

Unit B. Animal Science and the Industry

Problem Area 4. Understanding Animal Reproduction and Biotechnology

Lesson 1. Anatomy and Physiology of Animal Reproductive Systems

New Mexico Content Standard:

Pathway Strand: Animal Systems

Standard: IV: Know the factors that influence an animal's reproductive cycle to explain species response.

Benchmark: IV-A. Analyze elements in the reproductive cycle to explain differences between male and female reproductive systems.

Performance Standard: 1. Identify the parts of male and female reproductive tracts on example animals. 2. Analyze the reproductive cycle of a given animal. 3. Evaluate animal readiness for breeding.

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

1. Identify and describe the male reproductive organs in mammals.
2. Identify and describe the female reproductive organs in mammals.
3. Identify and describe the male and female reproductive organs in poultry.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Gillespie, J.R. *Modern Livestock & Poultry Production*, 6th Edition. Albany, NY: Delmar. 2002. (Unit 10)

Other Resources. The following resources will be useful to students and teachers:

Baker, M. & Mikesell, R.E. *Animal Science Biology and Technology*. Danville, IL: Interstate Publishers, Inc. 1996. (Chapter 5)

Lee, J.S., Hutter, J., Rudd, R., Westrom, L., Bull, A.M., Embry Mohr, C. & Pollock, J. *Introduction to Livestock and Companion Animals*, 2nd Edition. Danville, IL: Interstate Publishers, Inc. 2000. (Chapter 5)

Taylor, R.E. *Scientific Farm Animal Production: An Introduction to Animal Science*, 4th Edition. New York: MacMillian Publishing Co. 1992. (Chapter 10)

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters

Terms. The following terms are presented in this lesson (shown in bold italics):

Alimentary canal
Bladder
Cervix
Clitoris
Cloaca
Copulation
Cowper's gland
Epididymis
Fallopian tubes
Follicles
Funnel
Gamete
Gestation
Infundibulum
Isthmus
Labia majora
Labia minora

Magnum
Mucosal cells
Ova
Ovary
Oviducts
Papilla
Parturition
Penis
Prostate gland
Scrotum
Semen
Seminal vesicles
Sheath
Sperm
Spermatozoa
Testicles
Testosterone
Urethra
Urine
Uterine horns
Uterus
Vagina
Vas deferens
Vulva
Zygote

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 students to name a part on a car. Make a list of 5–8 on the chalkboard. Ask students to briefly explain each parts function in the operation of the car. Then ask students “Why is it important for a car mechanic to be able to identify and know the function of these parts?” After a brief discussion, ask students “Is it important for a livestock producer to know the parts of an animal? If so, why?”

Summary of Content and Teaching Strategies

Objective 1: Identify and describe the male reproductive organs in mammals.

Anticipated Problem: What are the major reproductive organs in male mammals? What are the functions of those organs?

- I. To have a successful livestock operation, a producer must have an understanding of the functions of the various reproductive organs. In most cases, a livestock operation will have only a limited number of males available for breeding. The male reproductive system contains several interconnected parts that must all work together in order to have successful mating. Some of the major organs found in the male mammal reproductive system are:
 - A. Testicles—The *testicles* produce *sperm*, the male sex cells also called *spermatozoa*. They also produce a hormone called *testosterone* that causes the appearance and behavior of the animal to be masculine. There are two testicles present in male mammals.
 - B. Epididymis—The *epididymis* is the storage site for sperm cells. These cells enter the epididymis from the testicle to mature. Sperm become able to fertilize a female's *ova* or female sex cell, as it travels through the epididymis. There is a separate epididymis attached to each testicle.
 - C. Scrotum—The *scrotum* is a two-lobed sac that contains and protects the two testicles. It also regulates the temperature of the testicles, maintaining them at a temperature lower than body temperature. When the environment temperature is low, the scrotum contracts, pulling the testicles toward the body and its warmth. When the environmental temperature is high, the scrotum relaxes, permitting the testicles to drop away from the body. Maintaining the correct temperature is critical in that being too hot or too cold can affect the production and vitality of sperm.
 - D. Vas Deferens—The *vas deferens* is essentially a transportation tube that carries the sperm-containing fluid from each epididymis to the urethra.
 - E. Urethra—The *urethra* is a large, muscular canal extending from the urinary bladder. Both semen and urine move through the urethra to the end of the penis.
 - F. Accessory Sex Glands—There are several glands that add volume and nutrition to the sperm-rich fluid coming from the epididymis.
 - G. Seminal vesicles—The *seminal vesicles* open into the urethra. They produce a fluid that protects and transports the sperm.
 - H. Prostate gland—The *prostate gland* is near the urethra and the bladder. It produces a fluid that is mixed with the seminal fluid.
 - I. Cowper's gland—The *cowper's gland* produces a fluid that moves down the urethra ahead of the seminal fluid. This fluid cleans and neutralizes the urethra. This helps protect the sperm as they move through the urethra. The mixture of the seminal and prostate fluid and the sperm is called *semen*.

- J. Penis—The **penis** deposits the semen within the female reproductive system. The urethra in the penis is surrounded by spongy tissue that fills with blood when the male is sexually aroused. This causes an erection that is necessary for **copulation**, or mating to occur. The sigmoid flexure (found in bulls, rams, and boars) and the retractor muscle extend the penis from the **sheath**, a tubular fold of skin. Horses and other mammals do not have a sigmoid flexure. The blood that fills the spongy tissue when sexual arousal occurs causes erection.

There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the major reproductive organs in male mammals and their functions. Unit 10 in Modern Livestock & Poultry Production is recommended. Use TM: B4–1A thru TM: B4–1C to aid in the discussion on this topic.

Objective 2: Identify and describe the female reproductive organs in mammals.

Anticipated Problem: What are the major reproductive organs in female mammals? What are the functions of those organs?

- II. Like males, female mammals have a complex system of organs that make up the reproductive system. It is important that those interested in animal production be familiar with these various organs and their functions. Some of the major organs that make up the female reproductive tract are:
- A. Ovary—The **ovary** produces female gametes. A **gamete** is a sex cell that can unite with other sex cells. These are called **ova** or eggs. A female mammal will typically have two ovaries. The ovaries also produce the female sex hormones estrogen and progesterone. Within each ovary there are hundreds of tiny **follicles** or cavities. The ova are produced in the follicles. Each ovum is the largest single cell in the body.
- B. Oviducts—The **oviducts** are two tubes that carry the ova from the ovaries to the uterus. The oviducts are also called the **fallopian tubes**. The oviducts are close, but not attached to the ovaries. The funnel-shaped end of each oviduct that is close to the ovary is called the **infundibulum**. At ovulation the follicle ruptures, releasing an ovum that is caught by the infundibulum. After copulation, sperm move through the uterus to the oviduct. Fertilization of the ovum occurs in the upper end of the oviduct. The **zygote**, or fertilized egg cell, moves to the uterus about two to four days after fertilization.
- C. Uterus—The **uterus** of mammals is a Y-shaped structure consisting of the body, two uterine horns, and the cervix. The size and shape of the uterus varies among the various species. The upper part of the uterus consists of the two **uterine horns** that develop into the oviducts or Fallopian tubes. Mammals that normally produce large numbers of offspring at each breeding have relatively large horns and a small body. Those species that normally produce single offspring or twins have smaller horns and a larger body. In most species pregnancy normally occurs in the uterine horns. In horses however, pregnancy normally occurs in the body of the uterus. In all species, the fetus grows within the uterus, where it remains until **parturition** or birth. The **cervix** is the lower outlet of the

uterus. It is composed primarily of connective tissue that constitutes the gateway between the uterus and the vagina. Like the rest of the reproductive tract, the cervix is lined with **mucosal cells**. These cells make significant changes as the animal goes from one estrous cycle to another and during **gestation** or pregnancy.

- D. Vagina—The **vagina** serves as the female organ of copulation at mating and as the birth canal at parturition. It is the passage between the cervix and the vulva. The lining is moist during estrus and dry when the animal is not in estrus
- E. Bladder—The **bladder** collects the liquid waste, which is called **urine**. The urine passes through the urethra to the vagina. The urethra attaches to the floor of the vagina between the cervix and the vulva. The bladder is not considered part of the reproductive tract in females.
- F. Vulva—The **vulva** is the external opening of the reproductive and urinary systems. The exterior, and visible part of the vulva, consists of two folds called the **labia majora**. The **labia minora** are two folds located just inside the labia majora.
- G. Clitoris—The **clitoris** is the sensory and erectile organ of the female. It is located just inside the vulva. The clitoris develops from the same embryonic tissue as the penis in the male and produces sexual stimulation during copulation.

There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the major reproductive organs in female mammals and their functions. Unit 10 in Modern Livestock & Poultry Production is recommended. Use TM: B4–1D and TM: B4–1E to aid in the discussion on this topic.

Objective 3: Identify and describe the male and female reproductive organs in poultry.

Anticipated Problem: What the major male and female reproductive organs in poultry and their functions?

- III. The reproductive systems of poultry are similar to that found in mammals with a few differences. A basic description of the reproductive systems of male and female poultry follows.
 - A. The reproductive system of the male poultry includes the testicles, which are held within the body cavity rather than in a scrotum. The testicles produce the sperm and seminal fluid.
 - 1. The vas deferens carries the seminal fluid and sperm cells to the cloaca.
 - 2. The **cloaca** is the enlarged part where the large intestine joins the end of the alimentary canal.
 - 3. The **alimentary canal** is the food-carrying passage that begins at the mouth and ends at the vent.
 - 4. The **papilla** is the organ in the wall of the cloaca that puts the sperm cells into the hen's reproductive tract.
 - B. The reproductive system of female poultry has two ovaries and two oviducts. The right ovary and oviduct do not function. Only the left ovary and oviduct produce eggs. The

ova produced in the ovary develop into egg yolks. The oviduct of the chicken has five parts:

1. Funnel—The **funnel** receives the yolk from the ovary. The sperm cells that the chicken receives from the male are stored here.
2. Magnum—The **magnum** secretes the thick white of the egg. It takes approximately three hours for the thick white to be placed around the yolk in the magnum.
3. Isthmus—The yolk and thick white move from the magnum into the **isthmus**, where two shell membranes are placed around the yolk and thick white. This process takes approximately 1¼ hours.
4. Uterus—In the uterus, the thin white and the outer shell are added to the egg. The egg remains in the uterus about 20 hours.
5. Vagina—From the uterus, the egg moves into the vagina. The egg stays here only a short time after which it is laid. It takes about 25 to 27 hours for a chicken to produce one egg.

There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the major reproductive organs in male and female poultry and their functions. Unit 10 in Modern Livestock & Poultry Production is recommended. Use TM: B4-1F, TM: B4-1B, and TM: B4-1H to aid in the discussion on this topic.

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 in determining which objectives need to be reviewed or taught from a different angle. Questions at end of chapters in the textbook may also be used in the review/summary.

Application. Contact a local community college, university, or veterinarian to ask if preserved samples of reproductive tract would be available for use in your class. Ask students to identify the various organs.

Evaluation. Evaluation should focus on student achievement of the objectives for each lesson. Various techniques can be used, such as performance on the application activities. A sample written test is attached.

Answers to Sample Test:

Part One: Matching

1 = a, 2 = e, 3 = c, 4 = g, 5 = h, 6 = d, 7 = b, 8 = f

Part Two: Completion

1. cowper's gland
2. vulva

3. papilla
4. scrotum
5. vagina
6. isthmus

Part Three: Short Answer

See lesson content for scoring this question.

Test

Lesson B4–1: Understanding Animal Reproduction and Biotechnology

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | |
|--------------------|--------------|
| a. Cloaca | e. Ovary |
| b. Van deferens | f. Follicles |
| c. Fallopian tubes | g. Funnel |
| d. Uterus | h. Testicles |

- _____ 1. In poultry, the enlarged part where the large intestine joins the end of the alimentary canal.
- _____ 2. Produces female gametes.
- _____ 3. Two tubes that carry the ova from the ovaries to the uterus.
- _____ 4. Receives the yolk from the ovary.
- _____ 5. Produces sperm and a hormone called testosterone.
- _____ 6. A Y-shaped structure consisting of the body, two uterine horns, and the cervix.
- _____ 7. A transportation tube that carries the sperm-containing fluid from each epididymis to the urethra.
- _____ 8. Tiny cavities found in the ovaries.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. The _____ produces a fluid that moves down the urethra ahead of the seminal fluid that cleans and neutralizes the urethra.
2. The _____ is the external opening of the reproductive and urinary systems.
3. The _____ is the organ in the wall of the cloaca that puts the sperm cells into the hen's reproductive tract.
4. The _____ is a two-lobed sac that contains and protects the two testicles.

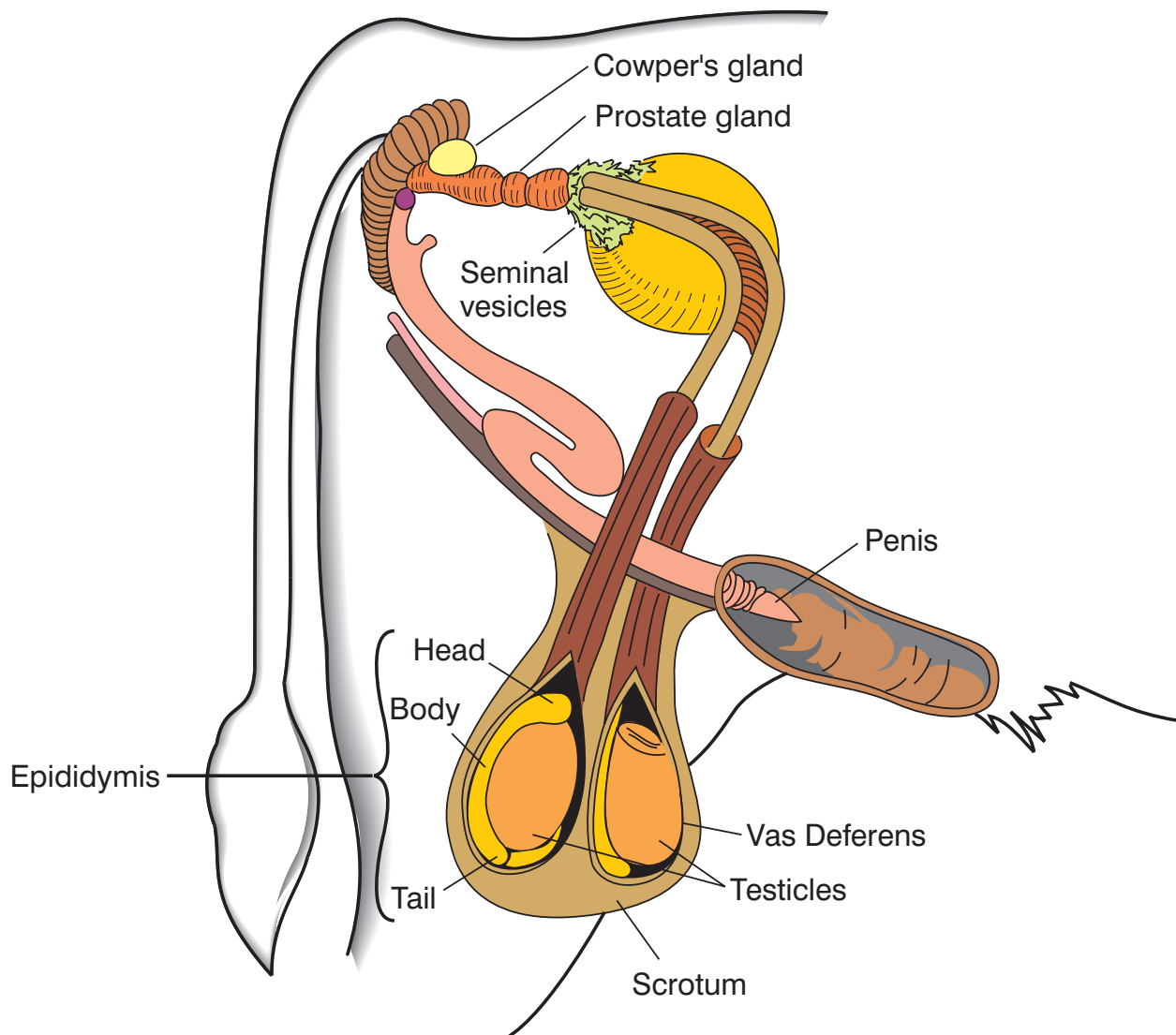
5. The _____ serves as the female organ of copulation at mating and as the birth canal at parturition.
6. The yolk and thick white move from the magnum into the _____.

Part Three: Short Answer

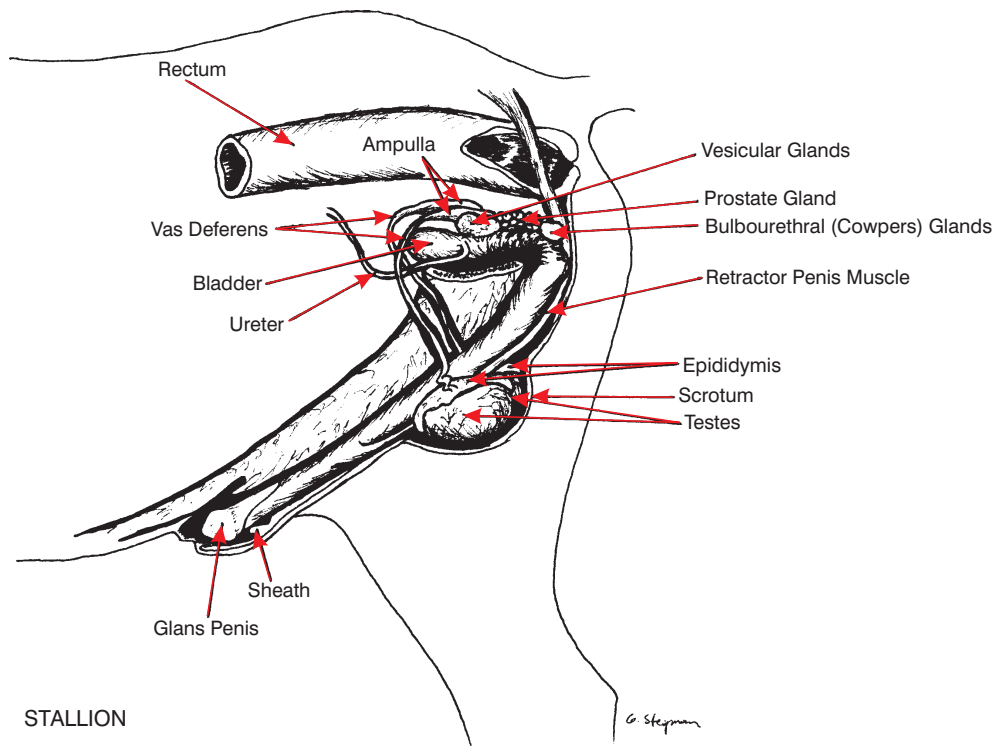
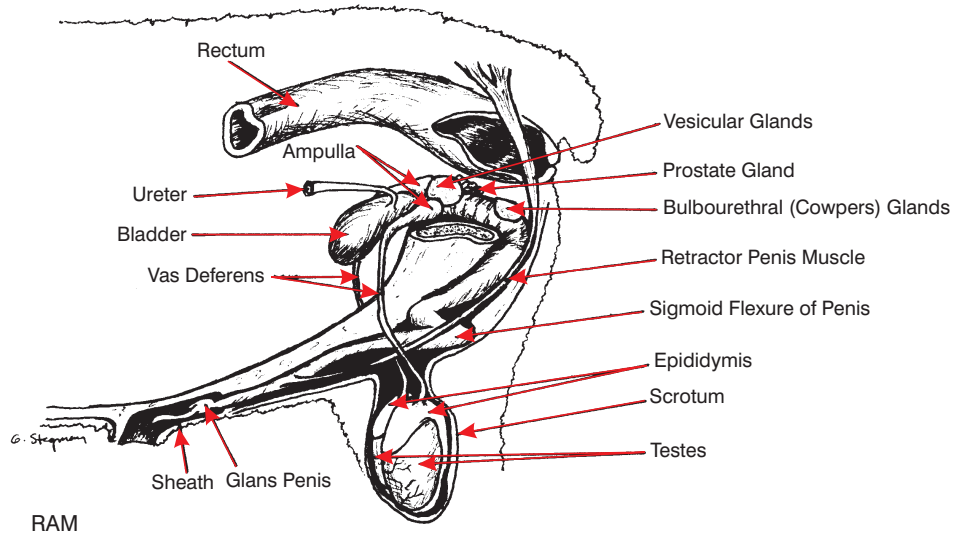
Instructions. Provide information to answer the following question.

Discuss the similarities and differences between the reproductive tracts of mammals and poultry.

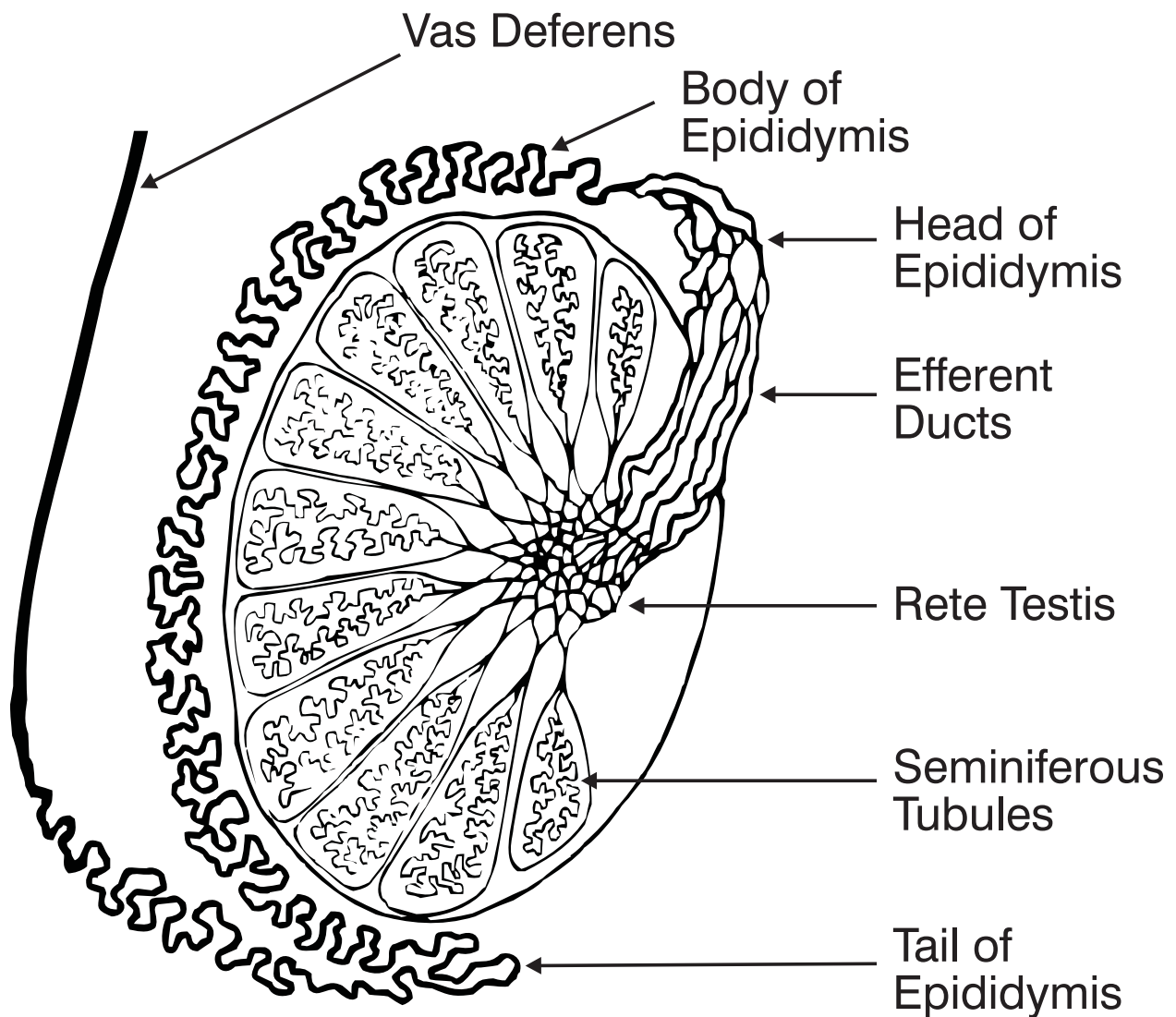
REPRODUCTIVE ORGANS OF THE BULL



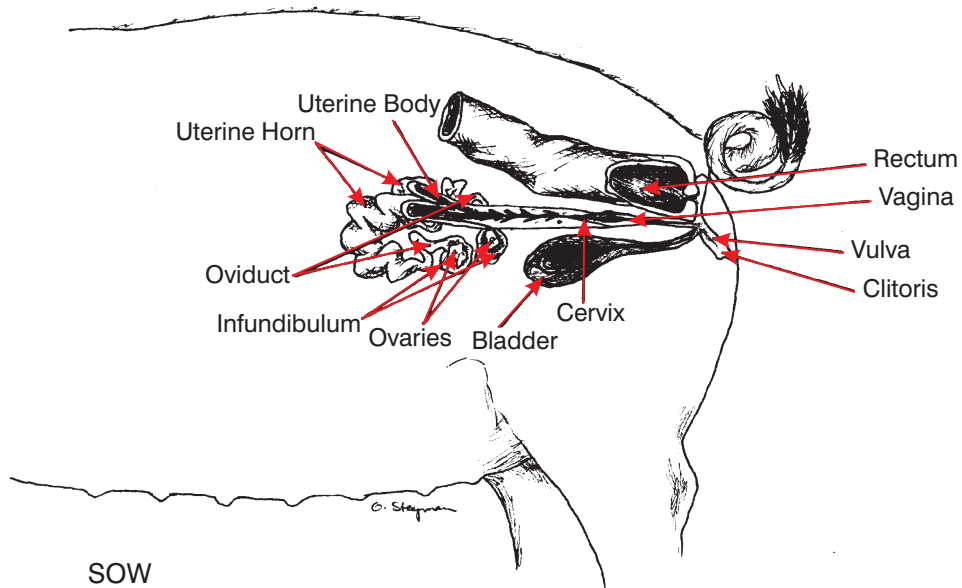
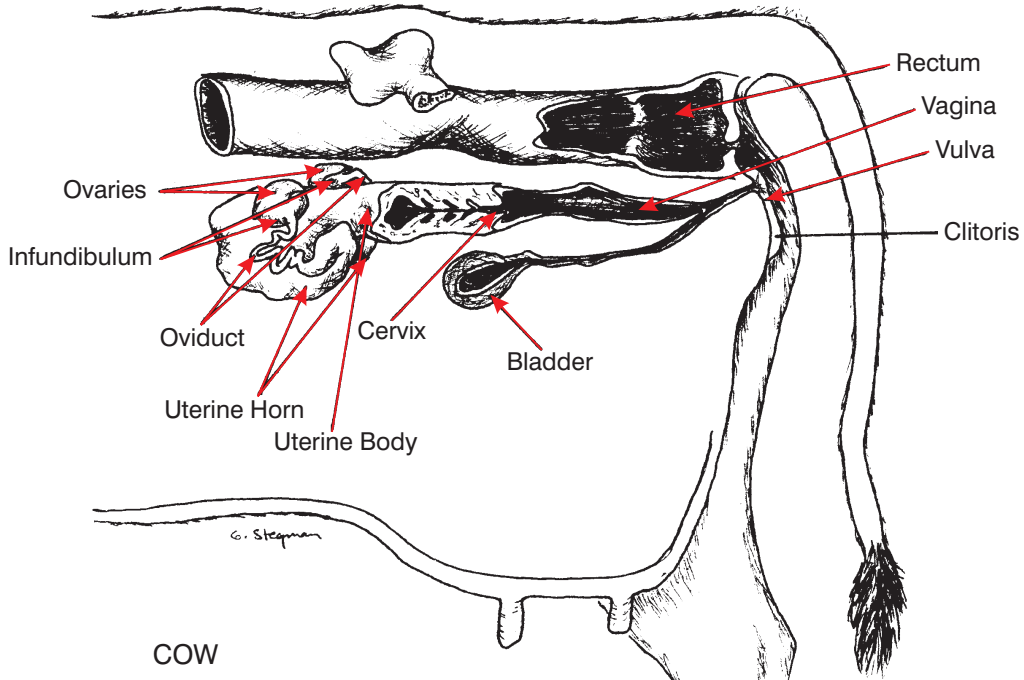
RAM AND STALLION REPRODUCTIVE ORGANS



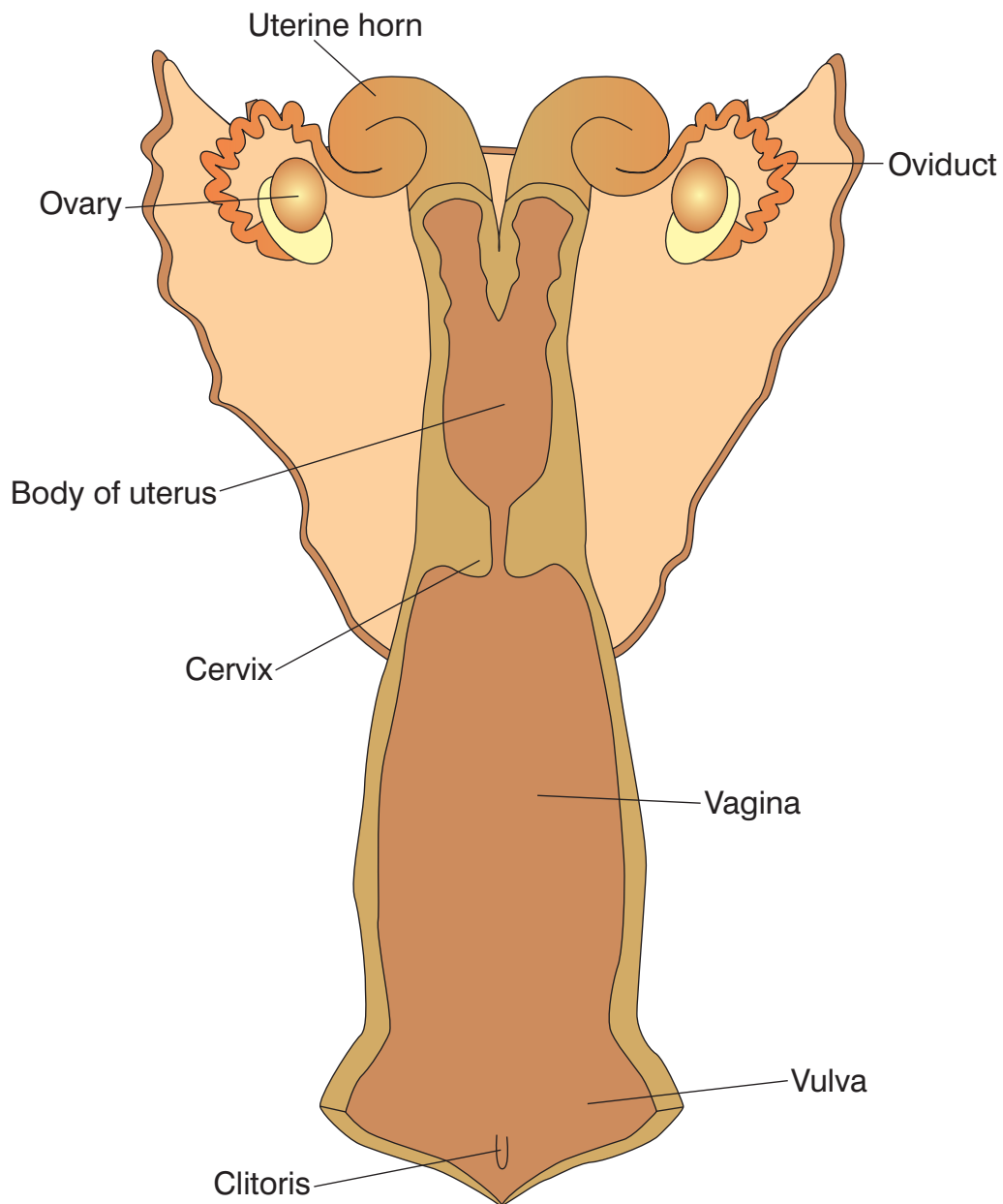
TESTES—PRIMARY REPRODUCTIVE ORGAN OF THE BULL



FEMALE REPRODUCTIVE ORGANS OF A COW

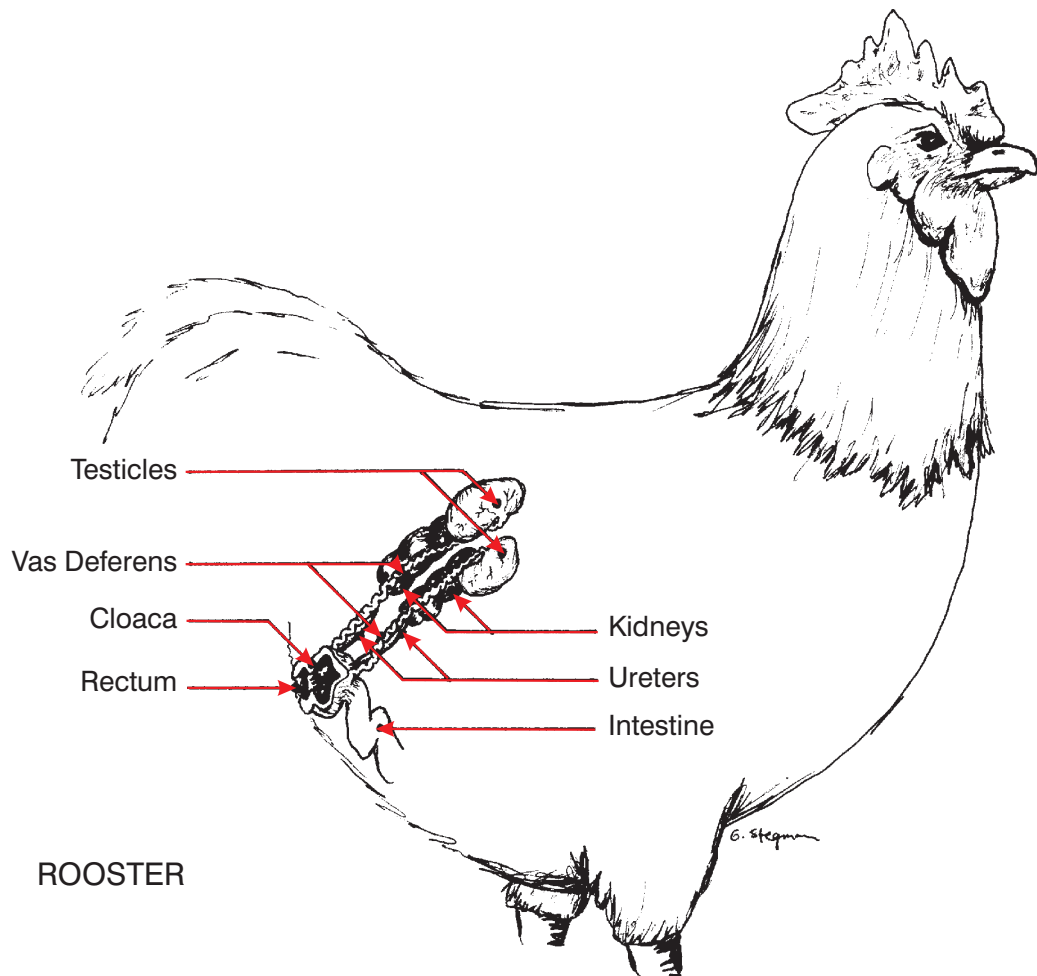


DORSAL VIEW OF THE REPRODUCTIVE SYSTEM OF A FEMALE COW

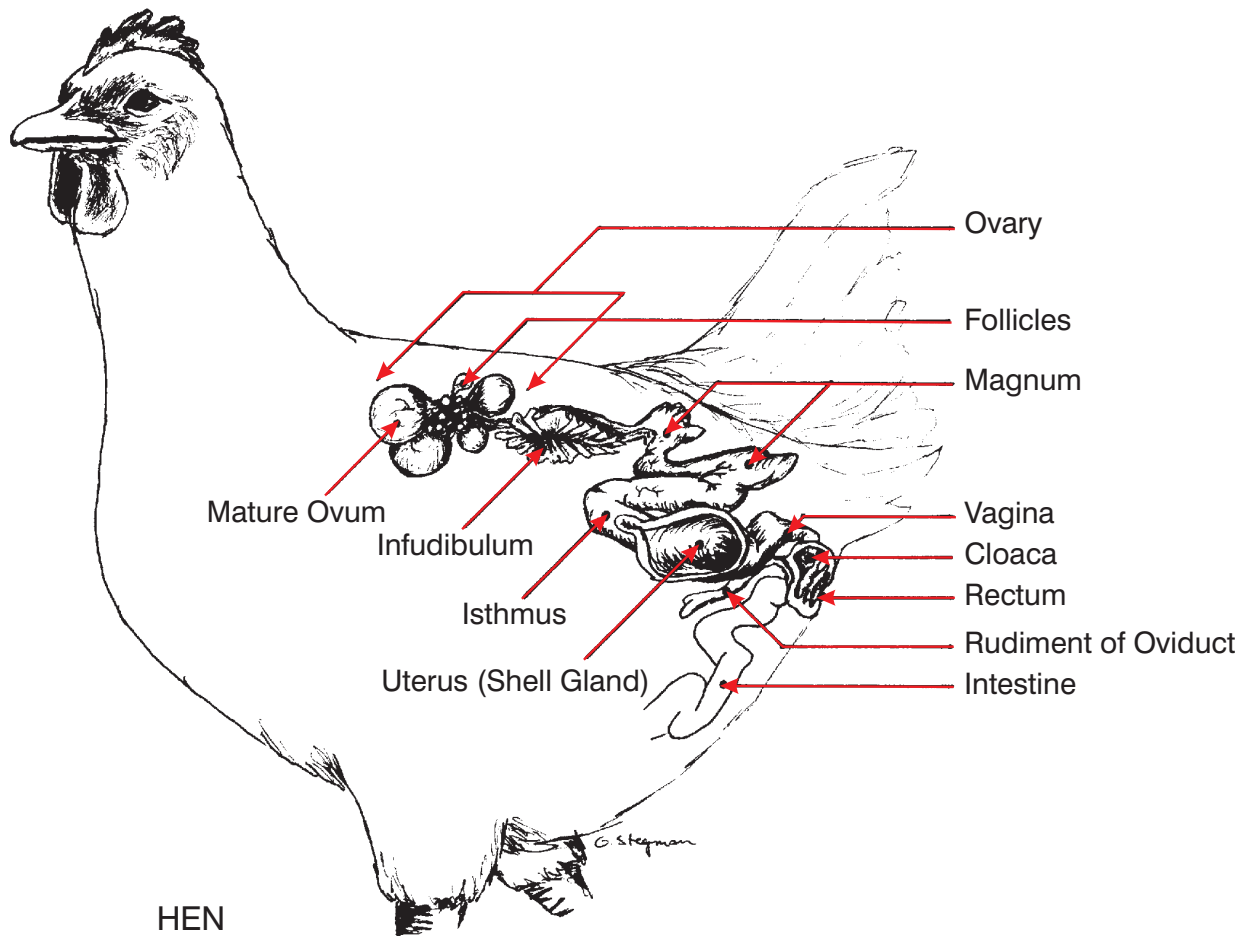


TM: B4-IF

REPRODUCTIVE ORGANS OF A MALE CHICKEN



REPRODUCTIVE ORGANS OF A FEMALE CHICKEN



MAJOR PARTS OF A CHICKEN EGG

