

Unit B: Understanding Animal Body Systems

Lesson 7: Understanding Animal Reproduction

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

1. Describe the importance and process of animal reproduction.
2. List the sexual classification of animals for major species.
3. List and explain common breeding systems used in livestock production.
4. List and describe the phases of the estrous cycle.
5. Explain the reproductive development of animals.

Recommended Teaching Time: 4 hours

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

Baker, MeeCee and Mikesell, Robert E. *Animal Science Biology and Technology*. Danville, Illinois: Interstate Publishers, Inc., 1996.

Gillespie, James R. *Animal Science*. Albany, New York: Delmar Publishers, 1998.

Taylor, Robert E. *Scientific Farm Animal Production*, 5th Edition. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1995.

List of Equipment, Tools, Supplies, and Facilities:

Writing surface
PowerPoint Projector
PowerPoint Slides
Transparency Masters

Terms: The following terms are presented in this lesson **PowerPoint Slides 2 and 3.**

Anestrus
Artificial insemination
Castration
Copulation
Diestrus
Egg
Ejaculation
Estrous cycle
Estrus
Fertilization
Gestation
Heat
Insemination
Lactation
Metestrus
Natural insemination
Neutering
Parturition
Proestrus
Puberty
Reproduction
Semen
Seminal glands
Seminal vesicles
Sexual classification
Sexual reproduction
Sperm
Sperm ducts
Steer

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 explain how a goat herder would increase the size of their herd. Students may name methods such as buying goats from someone else or breeding the goats that are owned. Have students assess which alternative would be used if money was not available to buy animals. Ask students to relate examples of animal reproduction on farms, with companion animals, or with laboratory or exotic species. Move from the interest approach into the objectives of the lesson and its content.

Summary of Content and Teaching Strategies

Objective 1: Describe the importance and process of animal reproduction

Anticipated Problem: Why is reproduction important? What is the process of animal reproduction?

Ask students to make a list of products that come from animals. Then, have them share a few items with their partner from their list. What if animals did not exist?

- I. **Reproduction** is the process by which animals produce offspring.
 - A. Offspring are the same species and have traits of their parents.
 - 1. Parents are selected and mated to achieve certain goals with offspring. Examples of goals include to produce offspring with high milk productivity or meaty carcasses.

PowerPoint Slide 4.

- 2. Reproduction results in new animals that are raised for the products they produce. Examples of products include meat, eggs, milk, and wool. **PowerPoint Slide 5.**
 - B. Most animals are produced with sexual reproduction. **Sexual reproduction** is the union of a sperm and an egg. Two parents are required.
 - 1. **Sperm** is the sex cell of male animals. They are produced in the testes.
 - 2. The **egg** or ovum is the sex cell of female animals. They are produced in the ovaries.

PowerPoint Slide 6. Ask students, “Where are the sperm produced?” “Where are the ovum or eggs produced in the reproductive tract?”

- C. **Fertilization** is the process by which the union of a sperm and an egg occurs. It is also known as conception.
 - 1. The union of the sperm with the egg occurs in the reproductive tract of the female. The process of placing sperm in reproductive tract of the female is known as **insemination. PowerPoint Slide 7.**
 - 2. **Natural insemination** occurs when a male of a species mates with a female of the same species. Sperm are placed in the female reproductive tract by the male during copulation. **Copulation** is the mating process in which sperm are ejaculated from the penis of the male in the vagina of the female. Females must be receptive to males at a time in the estrus cycle known as **heat. PowerPoint Slide 8.**
 - 3. Artificial insemination is used in some situations, such as with dairy cows. **Artificial insemination** is placing semen collected from a male in the female reproductive tract using equipment designed for the purpose. Artificial insemination must be done when the cow is in heat. **PowerPoint Slide 9. Ask students for some of the advantages**

of artificial insemination. Also, ask students why artificial insemination may not be used on some farms. Have students explain both answers.

- D. Once an egg has been fertilized, it becomes an embryo that attaches itself to the uterus for nourishment. The female is pregnant. The embryo goes through a time of development and becomes a fetus. The fetus develops to a stage where it is born and can live outside the uterus. **PowerPoint Slide 10.**

Use TM: 7-1 to help students with note taking. Have students keep notes on the major terms and concepts covered in class. Ask students to provide examples of animals that have recently given birth and the number of offspring produced. Ask students why baby animals have characteristics of their parents. If possible have newborn animals for students to observe.

Objective 2: List the sexual classification of animals for major species

Anticipated Problem: What sexual classifications are used for animals?

Ask students what would happen if all animals were able to mate at any time? There would likely be an overpopulation of animals and food would become scarce. Give examples if they are available in the area. Use this to lead into lesson content.

II. **Sexual classification** is the condition of an animal based on its age and sexual condition. It includes animals that are capable of reproduction as well as those that are not capable of reproduction. **PowerPoint Slide 11.**

A. An animal can be made incapable of reproduction by removing the ovaries or testes or altering the condition of the reproductive organs so that they are no longer fertile. The animals are not capable of conception. **PowerPoint Slide 12.**

1. **Castration** is the process of removing the testes from a male. It is a management practice used on young male animals. Castration eliminates unwanted breeding. It also promotes growth and development of young animals in more desirable ways with food animal production. Castration may be done surgically or by banding the testicles. (Note: Castration is also known as emasculation and gelding.) **PowerPoint Slide 13.**

2. **Neutering** is the process of making a female incapable of reproduction. It is also known as spaying. The ovaries of the female are removed or other procedures are used to render the female incapable of conception. (Note: Neutering can also refer to the castration of males but often refers specifically to females.) **PowerPoint Slide 14.**

Ask students to explain why it is more common for male animals to be castrated. Female neutering takes a surgical procedure to internally remove the ovaries. Castration can be done externally without surgery.

B. A number of terms are used to describe the sexual classification of animals. These terms vary by species, age, and gender. For example, a **steer** is a male bovine castrated at a young age and before sexual maturity was reached. Textbooks and references usually have lists of terms for the sexual classification of common species. **PowerPoint Slide 15.**

Use TM: 7-2 and TM: 7-3 as well as PowerPoint Slide 16 to help with note taking. As an activity, create index cards that have the sexual classification for the animals discussed on them. One card would have “steer” one would have “cow”, one would say “ewe” and so on. Distribute these to the class and see how fast they can organize themselves into groups by species. Time the performance and see if they can get faster.

Objective 3: List and explain common breeding systems used in livestock production.

Anticipated Problem: What are some of the common breeding systems used in livestock production?

Ask students to share experiences they have had with breeding livestock. What type of method did they use to determine what female should be bred to what male. Also, tell students to take 2 piece of paper and fold them in half to create their “Breeding Booklet.” Tell students to capture all important notes in this booklet.

III. The system of breeding to be used by a producer depends on the kind of livestock operation. There are two basic systems of breeding used in livestock production. There are several variations of each system available for producers to utilize. The two basic systems are:

- A. Straightbreeding—***Straightbreeding*** is mating animals of the same breed. There are several variations of this system. Some of the most common are:
 - 1. Purebred Breeding—A ***purebred*** animal is an animal of a breed. Both parents of the animal must have been purebred. The production of purebred animals is a specialized business. These animals provide the foundation stock for crossbreeding to produce market animals.
 - 2. Inbreeding—***Inbreeding*** is the mating of related animals. This increases the genetic purity of the stock produced. The pairing of the same genes is increased, and offspring become more genetically homozygous. There are two types of inbreeding. **PowerPoint Slide 17.**
 - a. Closebreeding—***Closebreeding*** is the most intensive form of inbreeding, in which the animals being mated are very closely related and can be traced back to more than one common ancestor. **PowerPoint Slide 18.**
 - b. Linebreeding—***Linebreeding*** refers to mating animals that are more distantly related and can be traced back to one common ancestor. **PowerPoint Slide 19. Linebreeding is a method that breeders will use to improve upon and try to eliminate structural and health problems from their animals. It is the breeding together of animals that have a well bred superior common ancestor who has attributes that the breeder is attempting to reproduce and improve upon in their own animals. Linebreeding is an attempt to concentrate the genetic contribution of an outstanding ancestor in the resulting offspring.**
- B. Outcrossing—***Outcrossing*** is the mating of animals of different families within the same breed. The purpose of Outcrossing is to bring into the breeding program traits that are desirable but not present in the original animals.
- C. Grading Up—***Grading up*** is the mating of purebred sires to grade females. A ***grade animal*** is any animal not eligible for registry as a purebred. This is done as less expensive way to improve the quality of animals on a farm or ranch. **PowerPoint Slide 20**
- D. Crossbreeding—***Crossbreeding*** is the mating of two animals from different breeds. The resulting offspring is a hybrid. This generally results in improved traits in the offspring. Superior traits that result from crossbreeding are called ***hybrid vigor*** or ***heterosis***. **PowerPoint Slide 21. This may include the crossbreeding of sheep and goats for a superior quality animal. Have students discuss situations where this may be helpful.**

After each topic, make sure students have all important information copied into their booklets. Also, encourage discussion about the different types of breeding programs. Ask students to share examples or stories they may have about experiences with breeding programs. Ask students to write a 1 page story about the breeding program they would have.

Objective 4: List and describe the phases of the estrous cycle.

Anticipated Problem: What are the phases of the estrous cycle? How are these related to reproduction?

Ask students to raise their hand if they have ever planted a garden. Then, ask one of those students how they knew what day to plant the garden. After they answer “because the conditions were right” lead that into the objective.

IV. The **estrous cycle** is the phases in the reproductive cycle between periods of estrus. These are the phases of reproductive readiness in the reproductive system of a mature female. The cycle does not occur during pregnancy nor when a female is in anestrus. **Anestrus** is the absence of cycling. It may occur due to disease, not being of reproductive age, or other conditions. **PowerPoint Slide 22.**

Have students create this cycle in their notes. Be sure to include the time of each occurrence.

A. The estrous cycle is comprised of four phases. The phases occur in a definite sequence unless the female is pregnant. (The sequence listed here is the sequence of occurrence.)

PowerPoint Slide 23.

1. **Estrus** is the phase when a female is in heat. The animal is receptive to mating and will stand for copulation with a male. Females exhibit signs of heat. An enlarged vulva and a discharge from it are signs. Some females exhibit behaviors indicating readiness for mating such as when a cow mounts another cow in the mating position. **PowerPoint Slide 24.**
2. **Metestrus** is the phase following heat. Ovulation occurs during metestrus as do other processes that help maintain a pregnancy should conception occur. **PowerPoint Slide 25.**
3. **Diestrus** is the phase in the estrous cycle when the reproductive system assumes that conception has occurred, even if it has not. Diestrus is several days long depending on the species of animal. **PowerPoint Slide 26.**
4. **Proestrus** is the period following diestrus in which preparation is being made by the reproductive system for the next heat period and ovulation. If conception has occurred, the estrous cycle ceases until it is renewed after gestation and parturition. **PowerPoint Slide 27.**

B. Animal producers can be more efficient in animal reproductive management if they know the phases of estrous. Careful observation by a trained producer and records on reproductive cycles will promote breeding to assure the production of young animals at the best time. For example, cattle producers often breed cows to assure calving in the spring when pasture grasses are beginning to grow. This allows a cow to produce maximum milk for the nutrition and growth of the calf. **PowerPoint Slide 28.**

Use TM: 7-4 to help with note taking. If possible, have students observe a female cow (or other species that exhibits visible signs) that is in heat and compare the signs with those of a female that is not in heat. Have an artificial insemination technician serve as a resource person in class and describe the signs used to know the time to artificially inseminate a female. Also ask students to repeat the estrous cycle as a form of review.

Objective 5: Explain the reproductive development of animals

Anticipated Problem: What are the phases in the reproductive development of animals?

Ask students if animals develop at the same rate humans do? What about crops? Humans take years to reach puberty, where as crops and livestock take a much shorter time.

- V. Animals of a species begin life as either a male or female. Their development as a member of their species includes reproductive development for their gender.
 - A. Reproductive development follows fairly definite stages and processes. **PowerPoint Slide 29.**
 - 1. Prepuberty is the stage of life of a young animal before it is capable of reproduction. Sufficient development has not been reached for an animal to reproduce. **PowerPoint Slide 30.**
 - 2. **Puberty** is the stage when an animal reaches a level of sexual development where it is capable of reproduction. Puberty occurs in both males and females. With females, the estrous cycle results in the release of mature eggs that can support the mating, conception, and gestation processes. With males, the animal is capable of producing viable sperm. Age of puberty varies with animal species and other conditions such as nutrition and health condition. Examples of when puberty is reached are: cattle 8-12 months, sheep 5-7 months, swine 4-7 months, and horses 12-15 months. **PowerPoint Slides 31 and 32.**
 - 3. **Gestation** is the period when a female is pregnant. The length of gestation varies with species though it tends to be consistent among members of the same species. For example, the gestation period is 114 days for sows and 337 days for a mare. The animal gives birth at the end of gestation. **PowerPoint Slide 33.**
 - 4. **Parturition** is the process of giving birth. Hormones are produced to support the birth process and prepare for lactation. **PowerPoint Slide 34.**
 - 5. **Lactation** is the secretion of milk by the mammary glands of a female. It is initiated by hormone activity. Lactation lasts for several months following parturition. **PowerPoint Slide 35.**
 - B. Mating behavior is a part of reproductive development. Both males and females of a species exhibit mating behavior. With males, this includes libido (desire to mate) and social status within a herd. With females, receptivity to mating occurs during heat. **PowerPoint Slide 36.**

Use TM: 7-5 to help students with note taking. If possible, have students observe animals at different stages of development. Ask them what types of physical differences they see in the animals.

Review/Summary: Use the objectives for the lesson as the structure for reviewing and summarizing the content of the lesson. Ask students what the stages of the estrous cycle are. Have students write this on the writing surface. Also, have student align themselves by species with index cards mentioned previously. Activities that may support summary and review include making a field trip to observe the breeding of an animal or observing the birth of an animal.

Application: Application can occur as students produce animals in on their farms or later in their careers. In some cases, school laboratories may have animals where students can apply information on animal reproduction.

Evaluation: Evaluation should be based on mastery of the objectives by the students. This can occur during instruction, review, or later as students apply the information. A written test can also be used. A sample written test is attached to the lesson plan.

Answers to Sample Test: B7-1:

Part One: Matching

1=i, 2=f, 3=a, 4=b, 5=d, 6=c, 7=e, 8=j, 9=h, 10=g

Part Two: Completion

1=Gestation, 2=Lactation, 3=Estrus, 4=steer, 5=Semen

Part Three: Short Answer

1. The paragraph should include mating and the process of fertilization. The major organs of males and females that produce sex cells can be included. The pregnancy, gestation, and parturition should be included.
2. Efficient reproduction is important because animal producers want more animals.

Part One: Matching

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

- | | |
|------------------------|------------------|
| a. sexual reproduction | f. estrous cycle |
| b. fertilization | g. ovary |
| c. sperm | h. testicle |
| d. egg | i. puberty |
| e. castrate | j. parturition |

- _____ 1. The stage at which an animal becomes capable of reproduction.
- _____ 2. The time between the periods of estrus.
- _____ 3. Reproduction that involves the union of an egg and sperm.
- _____ 4. The process by which union of an egg and sperm occurs.
- _____ 5. The female sex cell.
- _____ 6. The male sex cell.
- _____ 7. To remove the testicles from a male.
- _____ 8. The process of giving birth.
- _____ 9. The male organ that produces sperm.
- _____ 10. The female organ that produces eggs.

Part Two: Completion

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

- 1. _____ is the period when a female is pregnant.
- 2. _____ is the secretion of milk by the mammary glands of a female mammal.
- 3. _____ is the period when a female is in heat and receptive to breeding.
- 4. A _____ is a male bovine that has been castrated at a young age.
- 5. _____ is the fluid produced by males that contains sperm.

Part Three: Short Answer

Instructions: Provide information to answer the following questions.

1. Write a paragraph that describes the reproductive process in mammals.

2. Why is efficient reproduction important to animal producers?

Animal Reproduction

Reproduction—the process by which offspring are produced.

Sexual reproduction—the union of a sperm and egg

Sperm—male sex cell

Egg—female sex cell (also know as ovum)

Fertilization—process by which sexual reproduction occurs

Natural insemination—male of species deposits semen in the reproductive tract of a female

Animal Sexual Classification

Sexual classification—condition of an animal based on its age and sexual condition

Castrate—remove testes (testicles) from a male

Neuter—remove ovaries from a female

Sexual Classification of Selected Animals

Species	Young Animal ¹	Mature		Castrated Male
		Female	Male	
Cattle	calf	cow	bull	steer
Sheep	lamb	ewe	ram	wether
Goat	kid	doe	buck	wether
Chicken	chick	hen	rooster	capon
Horse male female	foal colt filly	mare	stallion	gelding

¹Young animal of either sex, except as indicated for horses.

The Estrous Cycle

Estrous cycle—the phases in the reproductive cycle from one estrus period (heat) to the next

Estrus—the phase when a female is receptive to mating—heat

Metestrus—the phase following heat when ovulation occurs and uterus is prepared for a pregnancy should conception occur

Diestrus—estrous cycle phase between metestrus and proestrus

Proestrus—phase following diestrus in which reproductive system is prepared for next estrus

Reproductive Development of Animals

Prepuberty—stage of life of a young animal before it is capable of reproduction

Puberty—stage when an animal is capable of reproduction

Gestation—period when a female is pregnant

Parturition—process of giving birth

Lactation—secretion of milk by mammary glands