

Course	Agricultural Science I
Unit	Introduction to Animal Reproduction
Lesson	Male Reproductive System
Estimated Time	50 minutes

Student Outcome

Explain the purpose of male reproductive parts and hormones.

Learning Objectives



1. Identify the male reproductive parts.
2. Describe the functions/purposes of the male reproductive parts.
3. Identify the male reproductive hormones.
4. Describe the role each male hormone plays in reproduction.

Grade Level Expectations

SC/LO/3/A/09-11/a

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slides
 - PPt 1 – Reproductive System of the Bull
 - PPt 2 – Reproductive System of the Boar
 - PPt 3 – Reproductive System of Fowl – Rooster
 - PPt 4 – Reproductive System of the Ram
 - PPt 5 – Reproductive System of the Stallion
 - PPt 6 – Reproductive System of the Dog
 - PPt 7 – Reproductive System of the Rabbit
 - PPt 8 – Male Reproductive Hormones
2. Activity Sheets
 -  AS 1 – Reproductive System of the Bull
 -  AS 2 – Dissection of a Testicle
3. *Introduction to Animal Reproduction (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1996.
4. *Introduction to Animal Reproduction Curriculum Enhancement*. University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- Obtain beef testicles for dissection; keep the testicles frozen until the dissection is performed.

Supplemental Information

1. Internet Sites
 - Animal Science Publications. MU Extension. University of Missouri-Columbia. Accessed April 12, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/>.








-
- ❑ Fanning, M, J. Selph, and S. Eubanks. "Managing Reproduction." *Florida Cow-Calf Management*. University of Florida. Accessed June 12, 2007, from <http://edis.ifas.ufl.edu/AN119>.
 - ❑ Hamilton, T. *Beef Bull Fertility*. Government of Ontario. Accessed June 14, 2007, from <http://www.omafra.gov.on.ca/english/livestock/beef/facts/06-015.htm>.
 - ❑ Loch, W. and J. W. Massey. *Horse Breeding Arithmetic: 2 + 2 = 1*. University of Missouri-Columbia Extension Division agricultural publication, G2790. Accessed June 12, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02790.htm>.
 - ❑ Managing Pig Health – Reproductive System. ThePigSite.com. Accessed June 12, 2007, from <http://www.thepigsite.com/pighealth/article/8/reproductive-system>.
 - ❑ Structure and Function of the Reproductive System of the Bull, Boar, and Stallion. University of Wisconsin. Accessed June 14, 2007, from http://www.wisc.edu/ansci_repro/lec/handouts/hd2.html.
 - ❑ Understanding Poultry Illness and Anatomy. Black Forest Poultry. Accessed June 14, 2007, from <http://www.blackforestpoultry.com/howto.html>.
-

Interest Approach

Display a beef testicle. Ask the students what it is. Then ask the students the following questions: What is the purpose of the testicle? How does a testicle assist in producing offspring?




Communicate the Learning Objectives

1. Identify the male reproductive parts.
2. Describe the functions/purposes of the male reproductive parts.
3. Identify the male reproductive hormones.
4. Describe the role each male hormone plays in reproduction.

Instructor Directions	Content Outline
<p>Objective 1</p> <p><i>Hand out AS 1. Label all the reproductive parts of the bull using PPt1. Display the PPTs for the swine, sheep, horse, dog, rabbit, and fowl. Discuss the differences among the species. Have students complete AS 2.</i></p> <p> AS 1 - Reproductive System of the Bull</p> <p> AS 2 - Dissection of a Testicle</p> <p> PPt 1 - Reproductive System of the Bull</p> <p> PPt 2 - Reproductive System of the Boar</p> <p> PPt 3 - Reproductive System of Fowl – Rooster</p> <p> PPt 4 - Reproductive System of the Ram</p> <p> PPt 5 - Reproductive System of the Stallion</p>	<p>Identify the male reproductive parts.</p> <p>Bull reproductive parts</p> <ol style="list-style-type: none">1. Testicles2. Scrotum3. Epididymis4. Vas deferens5. Seminal vesicles6. Prostate gland7. Cowper's (bulbourethral) gland8. Urinary bladder9. Urethra10. Sigmoid flexure11. Retractor muscle12. Penis13. Sheath <p>Boar reproductive parts</p> <ol style="list-style-type: none">1. Parts similar to the bull's, but testicles located at the rear of the boar2. Penis shaped like a corkscrew <p>Ram reproductive parts</p> <ol style="list-style-type: none">1. Filiform appendage extends from head of penis2. Sheath also referred to as prepuce <p>Stallion reproductive parts</p> <ol style="list-style-type: none">1. Less pendulous scrotum located further to rear of animal2. No sigmoid flexure

Instructor Directions	Content Outline
<p><input type="checkbox"/> PPt 6 – Reproductive System of the Dog</p> <p><input type="checkbox"/> PPt 7 – Reproductive System of the Rabbit</p>	<p>Dog reproductive parts</p> <ol style="list-style-type: none"> 1. No Cowper's gland or seminal vesicles 2. No sigmoid flexure 3. Sheath of penis referred to as prepuce <p>Buck reproductive parts</p> <ol style="list-style-type: none"> 1. Scrotum referred to as inguinal pouch 2. Sheath referred to as prepuce 3. Prostate gland separated into three parts 4. No Cowper's gland 5. No sigmoid flexure <p>Fowl reproductive parts</p> <ol style="list-style-type: none"> 1. No scrotum 2. Testicles located within abdomen, next to backbone 3. Vas deferens connects testicles to cloaca, papillae, and vent 4. Papillae within cloaca 5. No urethra or urinary bladder
<p>Objective 2</p> <p><i>Discuss the function and purpose of each of the reproductive parts of the bull. Explain the functions of any reproductive parts found in other species not found in the bull. Use PPt1 as an illustration while explaining the functions.</i></p> <p><input type="checkbox"/> PPt 1 – Reproductive System of the Bull</p>	<p>Describe the functions/purposes of the male reproductive parts.</p> <p>Functions of bull reproductive parts</p> <ol style="list-style-type: none"> 1. Testicles - produce sperm and hormones associated with reproduction 2. Scrotum - carries testicles and regulates their temperature 3. Epididymis - stores, concentrates, and transports sperm 4. Vas deferens - transports sperm from the epididymis to the urethra 5. Urethra - carries sperm and urine to the penis 6. Urinary bladder - stores urine; has no reproductive function 7. Seminal vesicles - produce seminal fluid that transports and protects the sperm 8. Prostate gland - nourishes the sperm with a thick, milky fluid 9. Cowper's (bulbourethral) gland - releases fluid into urethra to cleanse and neutralize it to allow sperm to survive in it 10. Sigmoid flexure - extends the penis outside the body during mating

Instructor Directions	Content Outline
	<p>11. Retractor muscle - pulls the penis back into the body</p> <p>12. Penis - deposits semen in the female reproductive tract and excretes urine from the body</p> <p>13. Sheath - covers and protects the penis when it is relaxed</p> <p>Functions of the boar reproductive parts - the same as the bull's</p> <p>Functions of the ram reproductive parts - the same as the bull's; filiform appendage is an extension of the urethra</p> <p>Functions of the stallion reproductive parts - the same as the bull's</p> <p>Functions of the dog reproductive parts - the same as the bull's</p> <p>Functions of the buck reproductive parts - the same as the bull's</p> <p>Functions of the fowl reproductive parts</p> <ol style="list-style-type: none"> 1. Testicles - produce sperm and hormones and secrete seminal fluid 2. Vas deferens - transports sperm and seminal fluid from the testicles to the cloaca 3. Cloaca - the site where the reproductive and digestive systems are joined; joins the female cloaca when mating 4. Papillae - transport sperm the female reproductive tract during mating 5. Vent - empties reproductive and digestive products from the body
<p>Objective 3</p> <p><i>Ask students to explain what a hormone is. Emphasize where the various hormones originate. Use PPT8 to discuss hormones in all species except fowl.</i></p> <p><input type="checkbox"/> PPT 8 – Male Reproductive Hormones</p>	<p>Identify the male reproductive hormones.</p> <ol style="list-style-type: none"> 1. Gonadotrophin releasing hormone (GnRH); not present in fowl 2. Follicle stimulating hormone (FSH) 3. Luteinizing hormone (LH), also known as interstitial cell stimulating hormone (ICSH) 4. Androgens - testosterone; another androgen produced in rabbits

Instructor Directions	Content Outline
<p>Objective 4</p> <p><i>Discuss the importance of male hormones in reproduction. Point out that each hormone has a role and that together they are in a delicate balance. Emphasize that hormones are the reason successful reproduction occurs. Continue to use PPT8 while discussing each hormone.</i></p> <p> PPT 8 – Male Reproductive Hormones</p>	<p>Describe the role each male reproductive hormone plays in reproduction.</p> <ol style="list-style-type: none"> 1. GnRH - stimulates the anterior pituitary gland in the brain to release FSH and LH, except in fowl, in which FSH production in fowl triggered by increased light 2. FSH - stimulates the seminiferous tubules to produce sperm 3. LH - stimulates the interstitial cells to secrete androgens 4. Androgens (testosterone) - stimulate the development, growth, and activity of reproductive parts; trigger puberty and the development of secondary sex characteristics; stimulate sex drive; function in the production of sperm
<p>Application:</p> <p> AS 1 – Reproductive System of the Bull</p> <p> AS 2 – Dissection of a Testicle</p>	<p>Answers to AS 1</p> <ol style="list-style-type: none"> 1. Prostate gland 2. Seminal vesicles 3. Cowper’s (bulbourethral) gland 4. Urinary bladder 5. Retractor muscle 6. Vas deferens 7. Urethra 8. Penis 9. Sigmoid flexure 10. Sheath 11. Testicle 12. Epididymis 13. Scrotum <p>Answers to “Key Questions” on AS 2</p> <ol style="list-style-type: none"> 1. Head of the epididymis 2. Seminiferous tubules 3. Sperm is produced in the seminiferous tubules of the testicle. The sperm move from the seminiferous tubules through the head, body, and tail of the epididymis and enter the vas deferens from the testicle. <p>Other activities</p> <p>Contact a local veterinarian to obtain a male reproductive tract from any animal species. Do a dissection, identifying and explaining all the male reproductive parts.</p>

Instructor Directions	Content Outline
Closure/Summary	Reproduction is vital for the survival of each species. Male reproductive parts and hormones have specific and important roles in reproduction.
Evaluation: Quiz	<p>Answers:</p> <ol style="list-style-type: none"> 1. Seminal vesicles 2. Vas deferens 3. Prostate gland 4. Cowper's (bulbourethral) gland 5. Urinary bladder 6. Retractor muscle 7. Urethra 8. Testicle 9. Sigmoid flexure 10. Epididymis 11. Penis 12. Scrotum 13. Sheath 14. i 15. h 16. k 17. g 18. j 19. f 20. d 21. a 22. d 23. b 24. c

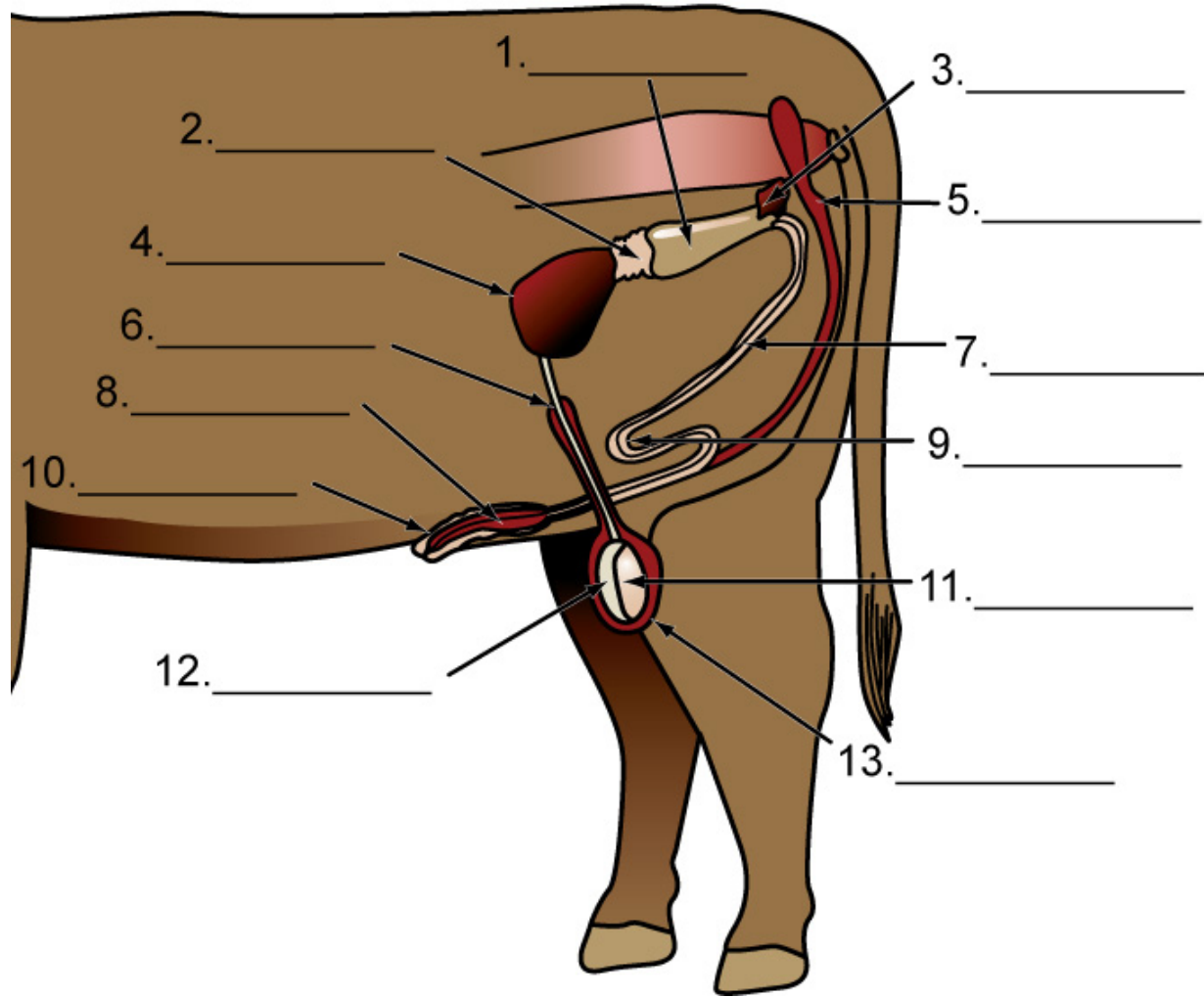
Lesson 1: Male Reproductive System

Name: _____

Reproductive System of the Bull

Objective: Identify the parts of the reproductive system of the bull.

Label the parts of the reproductive system.



Lesson 1: Male Reproductive System

Name: _____

Dissection of a Testicle

Objective: Identify the parts of the testicle in a lab dissection experiment.

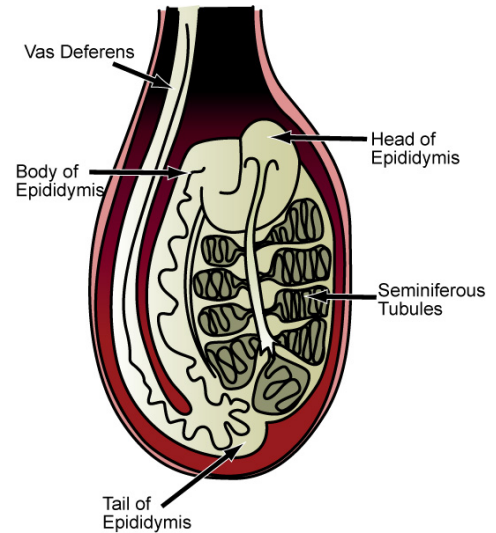
Activity Length: 30 minutes

Materials and Equipment:

Castrated beef testicle (large enough to dissect)
Dissecting knife
Lab coat
Lab gloves (palpation sleeves may also be used)

Procedure:

1. Before beginning the dissection, put on the lab coat and gloves.
2. Using a knife, cut the testicle at the point where the vas deferens ends and the epididymis begins. Set aside the vas deferens.
3. Separate the epididymis and the body of seminiferous tubules with the knife.
4. Cut the epididymis between the tail and body and set the tail section aside. Next, cut the remainder of the epididymis between the body and the head.

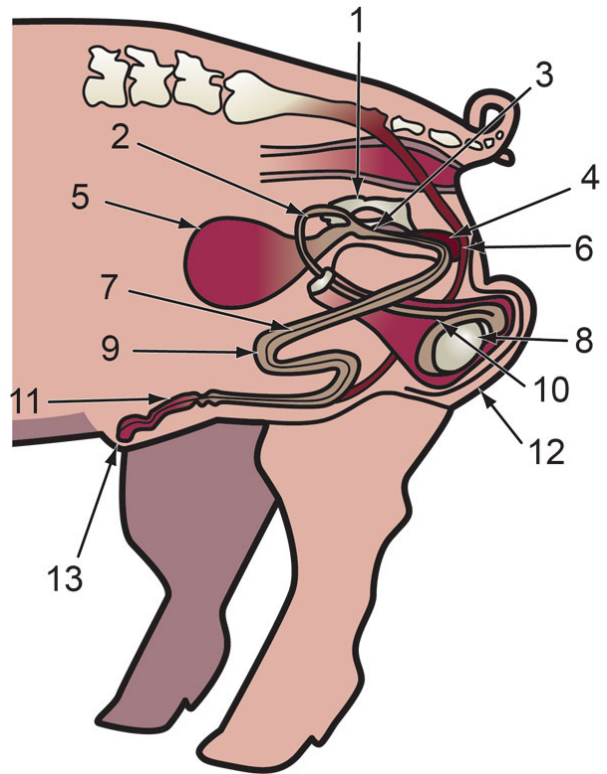
**Key Questions:**

1. Which part of the epididymis is attached to the body of seminiferous tubules?
2. In which part of the testicle does sperm originate?
3. What is the path taken by sperm within the testicle?

EVALUATION

Using the numbered diagram, fill in the name of the reproductive part of the boar on the blank provided next to the correct number.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____



Match the terms on the right with the best definition.

14. _____ Site where reproductive hormones are produced
15. _____ Muscle that extends the penis out of the body
16. _____ Carries sperm from the epididymis
17. _____ An enclosed sac that regulates the temperature of the testicles
18. _____ Transports semen and urine to the penis
19. _____ Secretes a fluid to transport and protect the sperm

- a. Cowper's gland
- b. Epididymis
- c. Penis
- d. Prostate gland
- e. Retractor muscle
- f. Seminal vesicles
- g. Scrotum
- h. Sigmoid flexure
- i. Testicles
- j. Urethra
- k. Vas deferens

Circle the letter that corresponds to the best answer.

20. Which hormone stimulates the testicles to produce testosterone?
- a. Estrogen
 - b. Follicle stimulating hormone (FSH)
 - c. Gonadotrophin releasing hormone (GnRH)
 - d. Luteinizing hormone (LH)
21. Which hormone triggers puberty?
- a. Follicle stimulating hormone (FSH)
 - b. Gonadotrophin releasing hormone (GnRH)
 - c. Luteinizing hormone (LH)
 - d. Testosterone
22. Which of the following is not a secondary sex characteristic?
- a. Aggressiveness
 - b. A deep voice
 - c. Heavily muscled neck and shoulders
 - d. The sex drive
23. Which hormone stimulates the pituitary gland to release essential reproductive hormones?
- a. Follicle stimulating hormone (FSH)
 - b. Gonadotrophin releasing hormone (GnRH)
 - c. Luteinizing hormone (LH)
 - d. Testosterone
24. Which hormone causes the release of androgens?
- a. FSH
 - b. GnRH
 - c. LH
 - d. Testosterone

Course	Agricultural Science I
Unit	Introduction to Animal Reproduction
Lesson	Female Reproductive System
Estimated Time	50 minutes

Student Outcome

Explain the purpose of female reproductive parts and hormones.

Learning Objectives



1. Identify the female reproductive parts.
2. Describe the functions/purposes of the female reproductive parts.
3. Identify the female reproductive hormones.
4. Describe the role each female hormone plays in reproduction.

Grade Level Expectations

SC/LO/3/A/09-11/a

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slides
 - PPt 1 - Reproductive System of the Cow – Top View
 - PPt 2 - Reproductive System of the Cow – Side View
 - PPt 3 - Reproductive System of the Sow – Top View
 - PPt 4 - Reproductive System of the Sow – Side View
 - PPt 5 - Reproductive System of Fowl – Hen
 - PPt 6 - Reproductive System of the Ewe
 - PPt 7 - Reproductive System of the Mare
 - PPt 8 - Reproductive System of the Bitch
 - PPt 9 - Reproductive System of the Doe
 - PPt 10 - Hormone Cycle
2. Activity Sheets
 -  AS 1 - Reproductive System of the Cow
 -  AS 2 - Dissection of a Female Reproductive Tract
3. *Introduction to Animal Reproduction (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1996.
4. *Introduction to Animal Reproduction Curriculum Enhancement*. University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- Obtain a female reproductive tract from a processing plant or veterinarian for dissection. Keep the reproductive tract frozen until the dissection is performed.

Supplemental Information

1. Internet Sites
 - Animal Science Publications. MU Extension. University of Missouri-Columbia.

Accessed April 12, 2007, from

<http://extension.missouri.edu/explore/agguides/ansci/>.







- ❑ Embryology in the Classroom (the hen's reproductive tract). Penn State College of Agricultural Sciences. Accessed June 14, 2007, from <http://4hembryology.psu.edu/female.html>.
 - ❑ Female anatomy. University of Bristol, England. Accessed June 15, 2007, from <http://137.222.110.150/calnet/abdpel11/page3.htm>.
 - ❑ Female Anatomy and Histology. University of Wisconsin. Accessed June 15, 2007, from http://www.wisc.edu/ansci_repro/lec/lec1/female_hist.html.
 - ❑ Female reproductive tract. University of Bristol, England. Accessed June 15, 2007, from <http://137.222.110.150/calnet/vetrep7/page2.htm>.
 - ❑ Loch, W. and J. W. Massey. *Horse Breeding Arithmetic: 2 + 2 = 1*. MU Extension. University of Missouri-Columbia. Accessed June 14, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02790.htm>.
 - ❑ Löfstedt, R. *Reproductive Physiology of Mares*. University of Prince Edward Island, Canada. Accessed June 15, 2007, from <http://people.upei.ca/lofstedt/opence/horsephysiol.html>.
 - ❑ Schoenian, S. "Reproduction in the Ewe." *Sheep 201: A Beginner's Guide to Raising Sheep*. Accessed June 15, 2007, from <http://www.sheep101.info/201/ewerepro.html>.
 - ❑ Singleton, W. and M. Diekman. *Reproductive Physiology and Anatomy of the Sow*. Purdue University Department of Animal Sciences. Accessed June 15, 2007, from <http://www.ansc.purdue.edu/swine/porkpage/repro/physiol/reppaper.htm>.
 - ❑ Sterle, J. and T. Safranski. *Artificial Insemination in Swine: Breeding the Female*. University of Missouri-Columbia. Accessed June 15, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02312.htm>.
 - ❑ Wattiaux, M. A. and W. T. Howard. "The Reproductive Function of Dairy Cattle." *Dairy Essentials*. University of Wisconsin. Accessed June 14, 2007, from http://babcock.cals.wisc.edu/downloads/de_html/ch08.en.html.
 - ❑ Whittier, J. C. *Reproductive Anatomy and Physiology of the Cow*. University of Missouri-Columbia. Accessed June 15, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02015.htm>.
-

Interest Approach

Display a reproductive tract to be used for the dissection in AS 2. Ask students if they can identify the different parts of the reproductive tract.

Communicate the Learning Objectives

1. Identify the female reproductive parts.
2. Describe the functions/purposes of the female reproductive parts.
3. Identify the female reproductive hormones.
4. Describe the role each female hormone plays in reproduction.

Instructor Directions	Content Outline
<p>Objective 1</p> <p><i>Hand out AS 1. Label all the reproductive parts of the cow using PPT1. Display the PPTs for the other species and discuss any differences. Have students complete AS 2.</i></p> <p> AS 1 - Reproductive System of the Cow</p> <p> AS 2 - Dissection of a Female Reproductive Tract</p> <p> PPT 1 - Reproductive System of the Cow – Top View</p> <p> PPT 2 - Reproductive System of the Cow – Side View</p> <p> PPT 3 - Reproductive System of the Sow – Top View</p> <p> PPT 4 - Reproductive System of the Sow – Side View</p>	<p>Identify the female reproductive parts.</p> <p>Cow reproductive parts</p> <ol style="list-style-type: none">1. Ovaries2. Infundibulum3. Oviducts (also called fallopian tubes)4. Uterus5. Uterine horns6. Cervix7. Vagina8. Urinary bladder9. Urethra10. Clitoris11. Vulva <p>Sow reproductive parts</p> <ol style="list-style-type: none">1. Uterine horns more prominent2. Cervix with protruding areas rather than folds as in the cow <p>Ewe reproductive parts - very similar to the cow's</p> <p>Mare reproductive parts - smoother cervix without folds like the cow's</p> <p>Bitch reproductive parts - more prominent uterine horns than the cow</p> <p>Doe reproductive parts</p> <ol style="list-style-type: none">1. Prominent uterine horns2. Two cervices

Instructor Directions	Content Outline
<ul style="list-style-type: none"> <input type="checkbox"/> PPt 5 - Reproductive System of Fowl – Hen <input type="checkbox"/> PPt 6 - Reproductive System of the Ewe <input type="checkbox"/> PPt 7 - Reproductive System of the Mare <input type="checkbox"/> PPt 8 - Reproductive System of the Bitch <input type="checkbox"/> PPt 9 - Reproductive System of the Doe 	<p>Fowl reproductive parts</p> <ol style="list-style-type: none"> 1. Only the left ovary and oviduct are functional 2. Oviduct with five parts - infundibulum, magnum, isthmus, uterus, and vagina 3. Cloaca 4. Vent
<p>Objective 2</p> <p><i>Discuss how each part of the female reproductive system works. Use PPt1 to guide the discussion on the functions of the cow's reproductive parts. Discuss any differences among the species.</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> PPt 1 - Reproductive System of the Cow – Top View 	<p>Describe the functions/purposes of the female reproductive parts.</p> <p>Functions of the cow's reproductive parts</p> <ol style="list-style-type: none"> 1. Ovary - produces ova (eggs) and female sex hormones 2. Infundibulum - receives the egg from the ovary 3. Oviduct - carries the egg from the ovary to uterus and is the site of fertilization 4. Uterus - location of the development of the fertilized egg 5. Uterine horns - the part of the uterus where the fertilized egg attaches and the fetus develops; litter-bearing animals have more pronounced uterine horns 6. Cervix - acts as a passageway to the uterus for sperm and keeps foreign material out during pregnancy by forming a waxy mucus plug; also acts as a part of the birth canal 7. Vagina - the site through which male semen is deposited into the female reproductive system, as well as a part of the birth canal and the passageway for urine 8. Urinary bladder - stores urine; has no reproductive function 9. Urethra - carries urine to the vagina from the bladder; has no reproductive function 10. Clitoris - stimulated during mating 11. Vulva - external opening to the vagina

Instructor Directions	Content Outline
	<p>Functions of the sow's reproductive parts - the same as the cow's</p> <p>Functions of the ewe's reproductive parts - the same as the cow's</p> <p>Functions of the mare's reproductive parts - the same as the cow's</p> <p>Functions of the reproductive parts of the bitch - the same as the cow's</p> <p>Functions of the reproductive parts of the doe - the same as the cow's</p> <p>Functions of the reproductive parts of the fowl</p> <ol style="list-style-type: none"> 1. Ovary - produces ova, with the nucleus of an egg attached to a yolk sac 2. Oviduct - transports the mature yolk to the cloaca; carries semen 3. Infundibulum - the site of fertilization; it receives the mature yolk from the ovary and stores semen in its folds 4. Magnum - secretes the albumen that surrounds the yolk 5. Isthmus - adds the shell membranes to the egg yolk and white 6. Uterus - adds a thin white, shell, and pigment 7. Vagina - produces the cuticle, or exterior egg coat, and stores the egg before laying 8. Cloaca - the junction of the digestive and reproductive systems; receives the male's semen and passes the egg during laying 9. Vent - opening through which the egg is laid
<p>Objective 3</p> <p><i>Ask students why hormones are important in the female reproductive system. Discuss the female hormones.</i></p>	<p>Identify the female reproductive hormones.</p> <p>Mammals</p> <ol style="list-style-type: none"> 1. Gonadotrophin releasing hormone (GnRH) 2. Follicle stimulating hormone (FSH) 3. Luteinizing hormone (LH) 4. Estrogen 5. Progesterone 6. Prostaglandin

Instructor Directions	Content Outline
	<p>Fowl</p> <ol style="list-style-type: none"> 1. FSH 2. LH 3. Estrogen 4. Progesterone
<p>Objective 4</p> <p><i>Discuss the role of hormones in successful reproduction. Use PPT 10 to show how the hormones function in the female reproductive system.</i></p> <p><input type="checkbox"/> PPT 10 – Hormone Cycle</p>	<p>Describe the role each female reproductive hormone plays in reproduction.</p> <p>GnRH - stimulates the release of FSH and LH</p> <p>FSH - stimulates the development of a mature ovum</p> <p>Estrogen - causes the development of sex organs and secondary sex characteristics and a desire to mate; also suppresses further FSH secretion from the pituitary and encourages the production of LH; assists in sperm transport by causing uterine contractions</p> <p>LH - causes the follicle to release the ovum and develops the corpus luteum</p> <p>Progesterone - prevents FSH and LH production, as well as follicle development and the secretion of estrogen; maintains a pregnancy by preventing uterine contractions and triggering secretions to nourish the egg and blocks further ovarian activity by inhibiting the secretion of GnRH</p> <p>Prostaglandin - ends progesterone production by causing the deterioration of the corpus luteum</p> <p>Hormones in fowl</p> <ol style="list-style-type: none"> 1. FSH - stimulates the reproductive system, developing the yolks and causing the secretion of estrogen and progesterone 2. Estrogen - increases blood calcium, protein, fats, vitamins, and other egg formation substances and separates the pubic bones and enlarges the vent for egg laying 3. Progesterone - causes the hypothalamus to trigger LH production 4. LH - stimulates the release of the mature yolk

Instructor Directions	Content Outline
<p>Application:</p> <p>AS 1 – Reproductive System of the Cow</p> <p>AS 2 – Dissection of a Female Reproductive Tract</p>	<p>Answers to AS 1</p> <ol style="list-style-type: none"> 1. Uterus 2. Uterine horn 3. Ovary 4. Uterine body 5. Bladder 6. Infundibulum 7. Oviduct 8. Cervix 9. Vagina 10. Opening of urethra 11. Clitoris 12. Vulva <p>Answers to “Key Questions” on AS 2</p> <ol style="list-style-type: none"> 1. Infundibulum 2. Ovary, infundibulum, oviduct, uterus, cervix, vagina, clitoris, and vulva 3. The sperm is deposited in the vagina and then travels through the cervix to the uterus and the oviduct. <p>Other activities</p> <p>Have a local veterinarian come and talk to the class about the female reproductive system and some problems that might occur that would make reproduction difficult or impossible.</p>
<p>Closure/Summary</p>	<p>The female reproductive system consists of a number of parts. Hormones also play a very important role in the development and functioning of the reproductive system. The parts and hormones interact together in a complex manner for successful reproduction.</p>
<p>Evaluation: Quiz</p>	<p>Answers:</p> <ol style="list-style-type: none"> 1. Uterine body 2. Uterus 3. Infundibulum 4. Bladder 5. Vagina 6. Clitoris 7. Uterine horn 8. Ovary 9. Oviduct

Instructor Directions	Content Outline
	<ol style="list-style-type: none"> 10. Cervix 11. Opening of urethra 12. Vulva 13. i 14. c 15. g 16. f 17. e 18. a 19. j 20. b 21. c 22. c 23. a 24. Infundibulum, magnum, isthmus, uterus, and vagina 25. Progesterone maintains the pregnancy by preventing uterine contractions and triggering secretions to nourish the egg. It also blocks further ovarian activity by inhibiting the secretion of GnRH. 26. FSH production is stimulated by increasing light. FSH develops the yolks and causes the secretion of estrogen and progesterone.

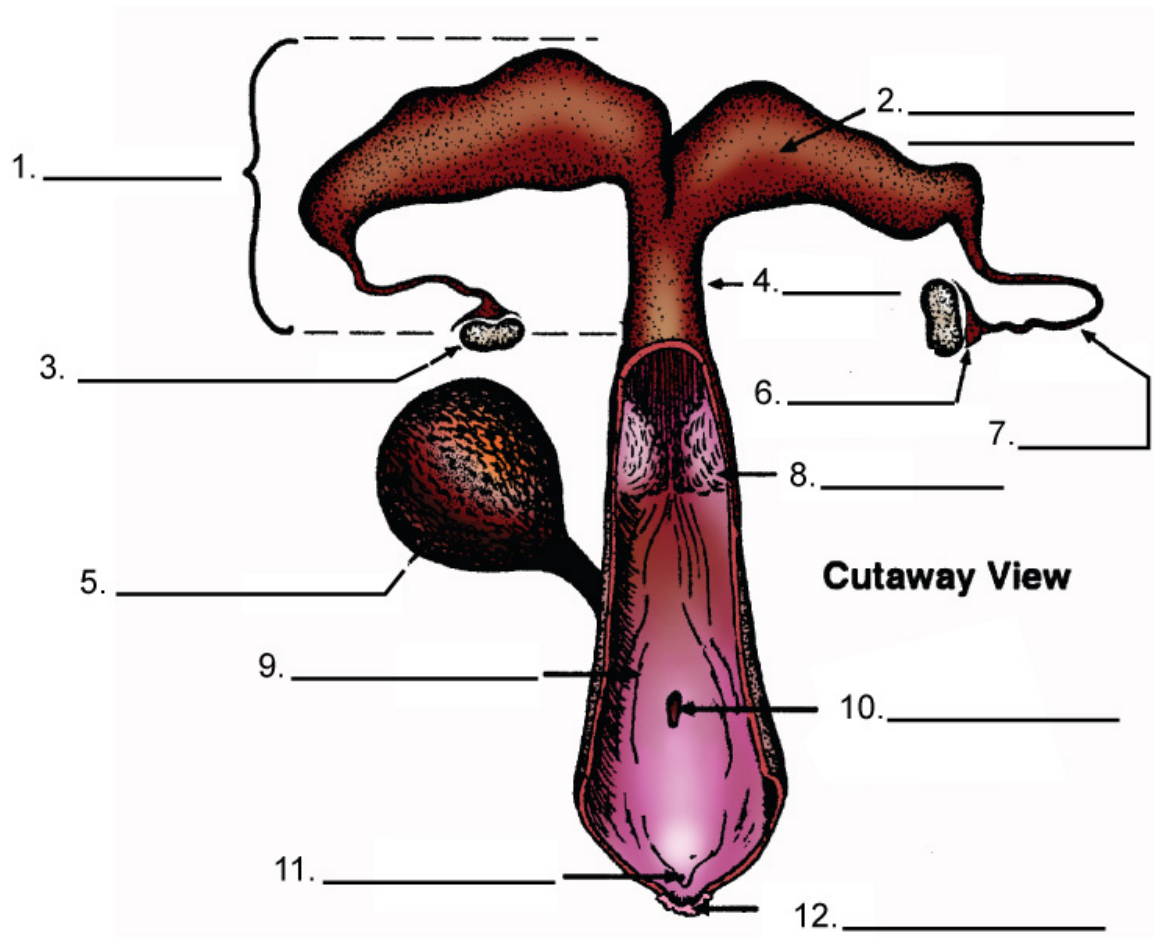
Lesson 2: Female Reproductive System

Name: _____

Reproductive System of the Cow

Objective: Identify the parts of the reproductive system of the cow.

Label the parts of the reproductive system.



Lesson 2: Female Reproductive System

Name: _____

Dissection of a Female Reproductive Tract**Objective:** Identify the female reproductive parts in a lab dissection exercise.**Activity Length:** 30 minutes**Materials and Equipment:**

Female reproductive tract

Dissecting knife

Lab coat

Lab gloves (palpation sleeves may be used)

Procedure:

1. Before beginning the dissection, put on the lab coat and gloves.
2. Locate the ovaries. Using the knife, separate them from the rest of the reproductive tract.
3. Locate the oviducts and sever them from the uterine horns. Note the infundibulum.
4. Next, cut between the cervix and the uterus, separating them. Make an incision to examine the interior of the uterus and the uterine horns.
5. Find the junction of the cervix and the vagina and separate the two organs.
6. Make an incision in the top of the vagina and locate the urethra opening and the clitoris at the base of the vagina.
7. Separate the vulva from the vagina.

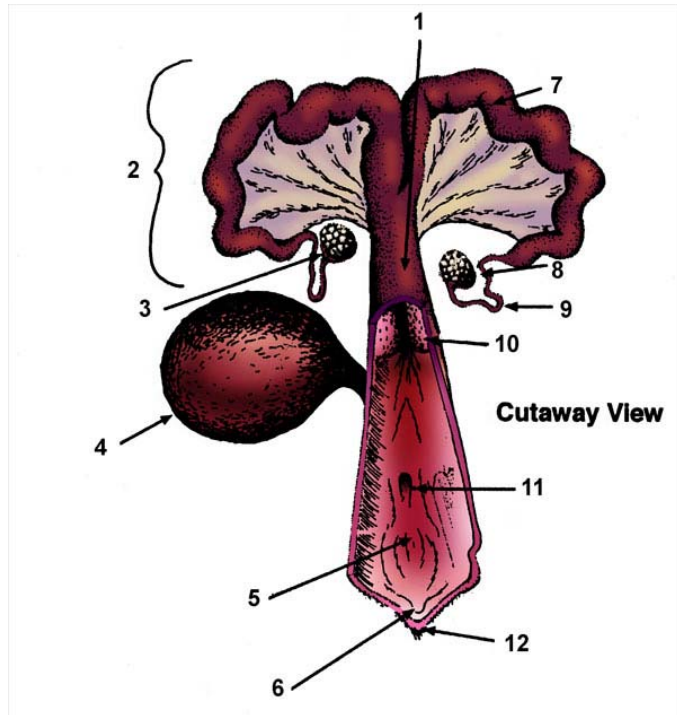
Key Questions:

1. What is the name of the part of the oviduct that is next to the ovary?
2. List in order the parts of the female reproductive system, starting with the ovary and ending with the external opening.
3. What is the path taken by the sperm when deposited in the female reproductive tract?

EVALUATION

In the blanks provided, label the numbered parts of the diagram of the reproductive system of a sow.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____



Match the terms listed on the right for the parts of the reproductive system of a cow and a fowl with the best definition.

- | | |
|---|--|
| <ol style="list-style-type: none"> 13. _____ Part that in a cow consists of two horns and a body 14. _____ A funnel-shaped part that received eggs from the ovary 15. _____ Site where fertilization occurs in the cow 16. _____ Organ in which eggs are generated and female sex hormones are produced 17. _____ Part that secretes the albumen that surrounds the egg in fowl 18. _____ Part located between the uterus and the vagina in the cow 19. _____ Site where semen is deposited in a cow by a bull | <ol style="list-style-type: none"> a. Cervix b. Clitoris c. Infundibulum d. Isthmus e. Magnum f. Ovary g. Oviduct h. Uterine horn i. Uterus j. Vagina k. Vulva l. Cloaca |
|---|--|

Circle the letter that corresponds to the best answer.

20. Which hormone stimulates the development and function of the follicle?

- a. Estrogen
- b. FSH
- c. LH
- d. Progesterone

21. Which hormone develops the corpus luteum, the yellow body?

- a. Estrogen
- b. FSH
- c. LH
- d. Progesterone

22. Which hormone prevents FSH and LH production?

- a. Estrogen
- b. GnRH
- c. Progesterone
- d. Prostaglandin

23. Which hormone develops the other sex organs?

- a. Estrogen
- b. FSH
- c. LH
- d. Progesterone

Complete the following short answer questions.

24. What are the five parts of the chicken's oviduct?

25. What is the role of progesterone in the sow after the egg is fertilized?

26. In fowl, what triggers the secretion of FSH, and what is its role in reproduction?

Course	Agricultural Science I
Unit	Introduction to Animal Reproduction
Lesson	Puberty and the Estrous Cycle
Estimated Time	50 minutes

Student Outcome

Explain the role of puberty and the estrous cycle in reproduction.

Learning Objectives

1. Describe what puberty is.
2. List the age at which each species reaches puberty.
3. Describe what estrus is.
4. Describe how estrous cycles differ for various species.
5. Describe how estrus length differs among species.
6. Describe the visual signs of estrus in each species.
7. List the factors that determine when an animal should be bred for the first time.

Grade Level Expectations

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slide
 - PPt 1 – Puberty Age, Estrous Cycle Length, and Estrus Length
2. Activity Sheet
 - AS 1 – Gathering Breeding Age Information
3. *Introduction to Animal Reproduction (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1996.
4. *Introduction to Animal Reproduction Curriculum Enhancement*. University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplemental Information

1. Internet Sites
 - Animal Science Publications. MU Extension. University of Missouri-Columbia. Accessed April 12, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/>.
 - Eilts, B. E. *Bovine Reproductive Herd Health*. Louisiana State University. Accessed June 15, 2007, from http://www.vetmed.lsu.edu/eiltslotus/Theriogenology-5361/bovine_intro_and_herd_health.htm.
 - Floyd, Jr., G. and D. Gimenez, Jr. *Estrus Synchronization Programs for Beef Herds*. Alabama Cooperative Extension System. Accessed June 15, 2007, from <http://www.aces.edu/pubs/docs/A/ANR-1027/>.
 - Kojima, F. N., J. F. Bader, B. E. Salfen, M. F. Smith, and D. J. Patterson. *Development of a New Estrous Synchronization Protocol for Beef Cattle with Short-Term Feeding of Melengestrol Acetate: 7-11 Synch*. Missouri Agricultural Experimental Station.

-
- University of Missouri. Accessed June 15, 2007, from <http://aes.missouri.edu/thompson/research/kojima.stm>.
- ❑ Löfstedt, R. *Reproductive Physiology of Mares*. University of Prince Edward Island, Canada. Accessed June 15, 2007, from <http://people.upei.ca/lofstedt/opence/horsephysiol.html>.
 - ❑ Lown, M. *Detection of Estrus in Mares*. Penn State University. Accessed June 15, 2007, from <http://www.das.psu.edu/user/equine/ansc407/horseBarnsProject/lowntease.htm>.
 - ❑ Puberty in Heifers. Partners in Reproduction. Accessed June 15, 2007 from <http://www.partners-in-reproduction.com/reproduction-cattle/puberty-heifers.asp>.
 - ❑ Rasby, R. and R. Vinton. *Estrus Cycle Learning Module*. University of Nebraska-Lincoln. Accessed June 15, 2007, from <http://beef.unl.edu/learning/estrous.shtml>.
 - ❑ Schoenian, S. "Reproduction in the Ewe." *Sheep 201: A Beginner's Guide to Raising Sheep*. Accessed June 15, 2007, from <http://www.sheep101.info/201/ewerepro.html>.
 - ❑ Singleton, W. and M. Diekman. *Reproductive Physiology and Anatomy of the Sow*. Purdue University Department of Animal Sciences. Accessed June 15, 2007, from <http://www.ansc.purdue.edu/swine/porkpage/repro/physiol/reppaper.htm>.
 - ❑ Sterle, J. and T. Safranski. *Artificial Insemination in Swine: Breeding the Female*. University of Missouri-Columbia. Accessed June 15, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02312.htm>.
 - ❑ Wattiaux, M. A. and W. T. Howard. "The Reproductive Function of Dairy Cattle." *Dairy Essentials*. University of Wisconsin. Accessed June 14, 2007, from http://babcock.cals.wisc.edu/downloads/de_html/ch08.en.html.
 - ❑ Whittier, J. C. *Reproductive Anatomy and Physiology of the Cow*. University of Missouri-Columbia. Accessed June 15, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02015.htm>.
-

Interest Approach

Ask students why it is important to know when to first breed an animal. Indicate that in order to benefit economically and productively through healthy offspring, the breeder must make a careful decision about when to breed for the first time based on puberty and the estrous cycle. Ask the students to define puberty and explain the role of the estrous cycle in reproduction.



Communicate the Learning Objectives

1. Describe what puberty is.
2. List the age at which each species reaches puberty.
3. Describe what estrus is.
4. Describe how estrous cycles differ for various species.
5. Describe how estrus length differs among species.
6. Describe the visual signs of estrus in each species.
7. List the factors that determine when an animal should be bred for the first time.

Instructor Directions	Content Outline
<p>Objective 1</p> <p><i>Ask students to explain puberty. Discuss puberty and its importance in reproduction. Describe what happens in the female reproductive system during puberty.</i></p>	<p>Describe what puberty is.</p> <p>Puberty is the stage during which the animal becomes sexually mature. In males, the animal is then able to produce viable sperm and has a desire to mate. In females, puberty involves the production of ova, the development of the reproductive tract, and a desire for mating. Puberty in the female mammal is identified by the first estrus.</p>
<p>Objective 2</p> <p><i>Each species goes through puberty. Point out that animals reach puberty at different ages. Compare species using PPt 1. Remind students that nutrition, physical size, and breed all affect the age at which a particular animal reaches puberty.</i></p> <p><input type="checkbox"/> PPt 1 – Puberty Age, Estrous Cycle Length, and Estrus Length</p>	<p>List the age at which each species reaches puberty.</p> <ol style="list-style-type: none">1. Heifer - between 6 and 12 months2. Gilt - between 4 and 8 months3. Ewe - between 5 and 9 months4. Mare - between 10 and 12 months5. Bitch - between 6 and 12 months6. Doe - between 5 and 8 months7. Fowl - chickens between 17 and 26 weeks; turkeys between 27 and 30 weeks
<p>Objective 3</p> <p><i>Ask students what estrus is and how it is connected to puberty.</i></p>	<p>Describe what estrus is.</p> <p>Estrus is the period in which the female is receptive to mating. Estrus occurs at intervals; each interval is called</p>

Instructor Directions	Content Outline
<p><i>Discuss the role the estrous cycle has in reproduction and describe the relationship between the estrous cycle and estrus.</i></p>	<p>an estrous cycle.</p> <p>During the estrous cycle, the reproductive tract is prepared for the release of the egg and to receive the fertilized egg.</p> <p>The estrous cycle has three phases.</p> <ol style="list-style-type: none"> 1. Proestrus - The follicle matures. 2. Estrus - The female is receptive to mating, and the egg is released. 3. Diestrus - The reproductive tract is less active.
<p>Objective 4</p> <p><i>Describe how the estrous cycle differs for various species, occurring at different times and seasons depending on the species. Use PPT 1 to compare the different estrous cycles.</i></p> <p><input type="checkbox"/> PPT 1 – Puberty Age, Estrous Cycle Length, and Estrus Length</p>	<p>Describe how estrous cycles differ for various species.</p> <p>Monoestrus species have estrus only once in a breeding season or year (e.g., dogs).</p> <p>Some species are polyestrus, with more than one estrus per breeding season or year. Sheep and horses are different from other polyestrus species in that they are seasonal breeders. In most breeds of sheep, the ewe has estrous cycles only during the fall. The period in which the ewe is not cycling is called anestrus. The mare usually experiences anestrus in the winter and cycles from around March until October or November. The variations in the estrous cycles of sheep and horses are triggered by changes in the length of days during the year.</p> <p>Estrous cycles also differ in length for different species.</p> <ol style="list-style-type: none"> 1. Cow - from 17 to 24 days, with an average of 21 days 2. Sow - between 18 and 24 days, with an average of 21 days 3. Mare - an average of 21 days, with a range of 18 to 25 days 4. Ewe - an average of 16 days, with a range of 14 to 20 days 5. Doe - an average of 15 days, with a range of 15 to 16 days 6. Bitch - does not have an estrous cycle, but is in anestrus until it experiences proestrus, estrus, and diestrus once each breeding season
<p>Objective 5</p> <p><i>Point out that estrus is a window of opportunity for mating, and</i></p>	<p>Describe how estrus length differs among species.</p> <ol style="list-style-type: none"> 1. Cow - an average length of 18 hours, with a 10 to 30 hour range

Instructor Directions	Content Outline
<p><i>consequently breeding, to occur. Stress that estrus length is an important consideration for breeding, since estrus is the only time when the female is receptive to mating. Refer to PPT 1 for comparisons.</i></p> <p><input type="checkbox"/> PPT 1 – Puberty Age, Estrous Cycle Length, and Estrus Length</p>	<ol style="list-style-type: none"> 2. Sow - an average of 3 days, with a range of 1 to 5 days 3. Ewe - an average of 30 hours and a range of 22 to 38 hours 4. Mare - an average of 5 days, with a range of 1 to 10 days 5. Bitch - an average of 9 days, with a 5 to 19 day range 6. Doe - does not have a well-defined estrus period, since ovulation is stimulated by mating
<p>Objective 6</p> <p><i>Discuss how an individual can determine whether an animal is in heat. Ask the students to list some common visual signs of estrus. Discuss the signs found in each species.</i></p>	<p>Describe the visual signs of estrus in each species.</p> <p>Cow</p> <ol style="list-style-type: none"> 1. Mounting other females or allowing itself to be mounted 2. Agitation or nervousness 3. Frequent urination 4. Swollen vulva 5. Vaginal discharges <p>Sow - same signs as the cow</p> <ol style="list-style-type: none"> 1. Occasional loud grunting 2. Immobile stance with ears held erect <p>Ewe</p> <ol style="list-style-type: none"> 1. Slightly swollen vulva 2. Vaginal mucus discharge 3. Seeking the ram and standing to be mounted <p>Mare</p> <ol style="list-style-type: none"> 1. Raised tail 2. Relaxed vulva 3. Mucus discharges 4. Disturbing other mares 5. Nervousness 6. Nickering 7. Frequent urination 8. Winking of vulva <p>Bitch</p> <ol style="list-style-type: none"> 1. Behavioral changes, such as an increase or decrease in appetite

Instructor Directions	Content Outline
	<ol style="list-style-type: none"> 2. Swollen vulva 3. Cessation of a bloody discharge begun during proestrus 4. Acceptance of the male for mating <p>Doe</p> <ol style="list-style-type: none"> 1. Reddish-purple, slightly swollen vulva 2. Acceptance of the male for mating
<p>Objective 7</p> <p><i>Ask students when a heifer should be bred the first time. Indicate that many factors play a role in determining the correct breeding time and that what might be the appropriate time for breeding for one heifer may not be the right time for another. Describe the factors to look for in deciding when to breed an animal. Have students complete AS 1.</i></p> <p> AS 1 - Gathering Breeding Age Information</p>	<p>List the factors that determine when an animal should be bred for the first time.</p> <p>Should not be bred at puberty; may not be physically equipped for successful reproduction</p> <p>Factors influencing the first breeding</p> <ol style="list-style-type: none"> 1. Physical size - weight and size of frame 2. Age - past puberty and fully sexually mature 3. Breed - variation of maturation time by breed
<p>Application:</p> <p> AS 1 - Gathering Breeding Age Information</p>	<p>Answers to AS 1</p> <p>Answers will depend on the responses from the sources.</p> <p>Other activities</p> <p>Using the information in the lesson, have students make an estrous cycle time line for each species. The time line should indicate the time at which puberty is expected to occur, as well as the average interval at which the estrous cycle repeats.</p>
<p>Closure/Summary</p>	<p>Puberty occurs in animals as they become sexually mature, which happens at different ages in different animals. The first estrus, which can be identified by certain visual signs, is an indication of puberty in the female. The length of estrus and the estrous cycle vary among species. After puberty occurs, physical size, age, and breed are factors to consider when determining when an animal should be bred for the first time.</p>

Instructor Directions	Content Outline
Evaluation: Quiz	<p>Answers:</p> <ol style="list-style-type: none">1. d2. b3. b4. b5. b6. c7. c8. a9. The five visual signs of estrus in the cow are mounting, agitation or nervousness, frequent urination, swollen vulva, and vaginal discharges from vulva.10. Age, physical size, and breed will determine when to first breed an animal.

Lesson 3: Puberty and the Estrous Cycle

Name: _____

Gathering Breeding Age Information**Objective:** Gather breeding information from local sources.**Activity Length:** Length depends on responses from sources.**Materials and Equipment:**

Sources of information for different breeds – veterinarians, feed companies, extension livestock specialists

Computer for letter writing

Procedure:

1. Select a source to contact for the information on when to breed different species and breeds for the first time. Choose three different breeds of one species of animal to research.
2. Prepare a letter requesting information regarding the age and weight at which each of the three species should first be bred. Mail the letter to the selected source.
3. After receiving information from the source, fill out the table, listing the species and breed and the age and weight at the first breeding. Include all of the information gathered by the class.

Key Questions:

1. What is the minimum age and weight a heifer can be bred? What breed is the heifer?
2. Which breed of swine is the oldest when first bred? What age should it be?
3. Which species can be bred at the youngest age?

EVALUATION

Circle the letter that corresponds to the best answer.

1. What is the name of the stage in which the reproductive tract develops?
 - a. Estrus
 - b. Diestrus
 - c. Proestrus
 - d. Puberty

2. A horse reaches puberty at _____ months.
 - a. 8
 - b. 12
 - c. 18
 - d. 24

3. What is the name of the stage in which the female is receptive to mating?
 - a. Diestrus
 - b. Estrus
 - c. Metestrus
 - d. Proestrus

4. Which of the following does not have an estrous cycle?
 - a. Cattle
 - b. Fowl
 - c. Sheep
 - d. Swine

5. Which species is monoestrus?
 - a. Cattle
 - b. Dogs
 - c. Horses
 - d. Sheep

6. What species has an average estrous cycle of 16 days?
 - a. Cattle
 - b. Horses
 - c. Sheep
 - d. Swine

7. A sow has an average estrus length of _____.
- a. 18 hours
 - b. 30 hours
 - c. 3 days
 - d. 5 days
8. In which species is ovulation triggered by the act of mating?
- a. Rabbits
 - b. Swine
 - c. Dogs
 - d. Horses

Complete the following short answer questions.

9. What are the five visual signs of estrus in the cow?
- a.
 - b.
 - c.
 - d.
 - e.
10. What are the factors examined when deciding when a female should be bred for the first time?

Course	Agricultural Science I
Unit	Introduction to Animal Reproduction
Lesson	Conception and Gestation
Estimated Time	50 minutes

Student Outcome

Describe conception and gestation.

Learning Objectives

1. Describe what conception is and where it occurs.
2. Describe the methods that are used to impregnate.
3. Explain the procedures used to determine pregnancy.
4. Describe what gestation is and its three stages.
5. Describe the embryonic membranes and their functions.
6. List the factors that influence the length of gestation.
7. Describe what incubation is.
8. Determine how gestation and incubation lengths differ among species.

Grade Level Expectations

SC/LO/1/B/09-11/b

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slides
 - PPt 1 - Embryonic Membranes of a Pig
 - PPt 2 - Gestation and Incubation Lengths for Different Species
2. Activity Sheet
 - AS 1 - Gestation and the Reproductive Tract
3. *Introduction to Animal Reproduction (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1996.
4. *Introduction to Animal Reproduction Curriculum Enhancement*. University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- Obtain sow reproductive tracts for examination.

Supplemental Information

1. Internet Sites
 - Alexander, M. A., et al. *Sheep Pregnancy Checking By Ultrasonic Sound*. MU Extension. University of Missouri-Columbia. Accessed June 18, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02610.htm>.
 - Animal Science Publications. MU Extension. University of Missouri-Columbia. Accessed April 12, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/>.
 - Cattle gestation table and calving date calculator. Cattle Today, Inc. Accessed June

-
- 18, 2007, from <http://www.cattletoday.com/gestation.shtml>.
- ❑ Lyons, J. J. *Small Flock Series: Incubation of Poultry*. MU Extension. University of Missouri-Columbia. Accessed June 18, 2007, from <http://extension.missouri.edu/explore/agguides/poultry/g08353.htm>.
 - ❑ Massey, J. W., J. C. Whittier, and C. J. Bierschwal. *Increase Your Calf Crop by Good Management, Pregnancy Testing and Breeding Soundness Examination of Bulls*. MU Extension. University of Missouri-Columbia. Accessed June 18, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02006.htm>.
 - ❑ Pregnancy Diagnosis in Cows and Heifers. Partners in Reproduction. Accessed June 18, 2007, from <http://www.partners-in-reproduction.com/reproduction-cattle/pregnancy-diagnosis.asp>.
 - ❑ Pregnancy in Cows and Heifers. Partners in Reproduction. Accessed June 15, 2007, from <http://www.partners-in-reproduction.com/reproduction-cattle/pregnancy-conception-gestation.asp>.
-


Interest Approach

1. Place one balloon inside another. Fill the inner balloon with water and tie it shut. Then fill the outer balloon with water. The balloons can be used to simulate the function of the placenta during gestation. Have students attempt to break the inner balloon to demonstrate how the fetus is protected during its development.
2. Ask students how they think an embryo develops in preparation for birth. Describe how gestation prepares the fetus to survive outside the mother's body. If possible, show pictures of an embryo and fetus during gestation.

Communicate the Learning Objectives

1. Describe what conception is and where it occurs.
2. Describe the methods that are used to impregnate.
3. Explain the procedures used to determine pregnancy.
4. Describe what gestation is and its three stages.
5. Describe the embryonic membranes and their functions.
6. List the factors that influence the length of gestation.
7. Describe what incubation is.
8. Determine how gestation and incubation lengths differ among species.

Instructor Directions	Content Outline
<p>Objective 1</p> <p><i>Ask students what happens during conception.</i></p>	<p>Describe what conception is and where it occurs.</p> <ol style="list-style-type: none">1. Conception occurs when a single sperm unites with the egg, creating an embryo.2. Conception occurs in the oviduct, usually in the upper third.3. In swine, dogs, and rabbits, multiple ova are released and fertilized.4. In fowl, the egg and sperm unite in the infundibulum. Fertilization takes place at the germinal disk on the yolk, which contains the nucleus.
<p>Objective 2</p> <p><i>In nature, for females to become pregnant, mating has to occur. However, other ways to impregnate a female do exist. Discuss with students the different ways in which a female may be impregnated. To illustrate the hormone cycle, refer back to PPT 10 in Lesson 2.</i></p>	<p>Describe the methods that are used to impregnate.</p> <p>Natural breeding - male copulates with the female</p> <p>Artificial insemination</p> <ol style="list-style-type: none">1. Semen is collected from the male and stored.2. During estrus, the previously collected semen is inserted into the female reproductive tract. <p>Embryo transfer</p> <ol style="list-style-type: none">1. The female releases many eggs during ovulation because of FSH injections.

Instructor Directions	Content Outline
	<ol style="list-style-type: none"> 2. The eggs are fertilized either by natural or artificial mating. 3. After conception, the embryos are collected from the female and transferred to other females for the pregnancy. 4. ET cannot be used in fowl.
<p>Objective 3</p> <p><i>Discuss the economic and biological importance of being able to determine pregnancy. Describe the different procedures used to determine pregnancy. Hand out AS 1 and complete the activity.</i></p> <p> AS 1 - Gestation and the Reproductive Tract</p>	<p>Explain the procedures used to determine pregnancy.</p> <p>Visual inspection</p> <ol style="list-style-type: none"> 1. No visual signs of estrus are present. 2. The abdomen is enlarged late in pregnancy. <p>Rectal palpation</p> <ol style="list-style-type: none"> 1. Rectal palpation involves inserting an arm into the rectum and feeling for the distended uterus or for cotyledons. 2. A modified version is used in sheep in which a rod is inserted in the rectum to move the fetus so it can be felt. <p>Abdominal palpation - The abdomen is externally examined by hand. During pregnancy, the uterus becomes enlarged and can be felt.</p> <p>Ultrasonic sound</p> <ol style="list-style-type: none"> 1. Used for many species, pregnancy checking by ultrasonic sound involves using a transducer attached to a machine and a sealant. 2. With a sealant being used to exclude air from between the transducer and the body, the transducer transmits ultrasonic sound waves through the body. 3. The sound waves are reflected by tissue. When the waves encounter a fetus, the unit will light up or sound to indicate pregnancy. <p>In a laboratory situation, pregnancy may be determined through blood tests or even x-rays.</p>
<p>Objective 4</p> <p><i>Ask students what gestation is. Discuss when gestation begins. Identify the three stages of</i></p>	<p>Describe what gestation is and its three stages.</p> <p>Gestation is the period of development for offspring beginning at conception and ending at birth. During gestation, the fetus receives nutrients and oxygen from the</p>

Instructor Directions	Content Outline
<p><i>gestation. Discuss the importance of gestation.</i></p>	<p>mother through the placenta and gives off carbon dioxide and waste products that are absorbed by the mother.</p> <p>The fetus goes through three stages of gestation.</p> <ol style="list-style-type: none"> 1. Cell division stage - The embryo undergoes 16 or more cell divisions as it is transported to the uterus. 2. Embryonic stage - Body parts are differentiated, and important organs are formed. When the embryonic stage is complete, a fetus has developed. 3. Fetal period - The fetus grows until birth.
<p>Objective 5</p> <p><i>Discuss why the embryo needs protection and nutrients. Using PPT 1, discuss the roles of each of the embryonic membranes in providing protection and nutrients.</i></p> <p><input type="checkbox"/> PPT 1 – Embryonic Membranes of a Pig</p>	<p>Describe the embryonic membranes and their functions.</p> <ol style="list-style-type: none"> 1. Chorion - The chorion is connected to the uterus. The points of attachment provide nourishment and waste disposal for the embryo. 2. Amnion - The amnion is a sac that surrounds the embryo itself and contains amniotic fluid to protect the embryo from shock. The umbilical cord connects the amnion to the embryo's navel. The cord also provides nourishment to the embryo. 3. Allantois - The allantois, which is an extension of the urinary system of the embryo, lies between the amnion and the chorion. It contains allantoic fluid, which originates in the embryo's kidney.
<p>Objective 6</p> <p><i>The length of gestation differs for each mother within a species. Ask students what would cause these differences in gestation lengths. Discuss the influence of these factors on gestation length.</i></p>	<p>List the factors that influence the length of gestation.</p> <ol style="list-style-type: none"> 1. Breed of the mother 2. Mother's age 3. Individual variation - Two mothers may be the same age and breed but may still have different gestation lengths. 4. Weather 5. Choice of sire
<p>Objective 7</p> <p><i>Discuss how the development of the embryo in fowl differs from the gestational process described above.</i></p>	<p>Describe what incubation is.</p> <ol style="list-style-type: none"> 1. The time from when the hen sits on an egg or it is placed in an incubator to its hatching is called incubation. Incubation is a period of fetal development analogous to gestation. 2. The embryo is nourished by the yolk. 3. The membranes that surround the embryo are the same as those found in mammals, although the

Instructor Directions	Content Outline
	chorion and the allantois merge to form the chorioallantoic membrane, which functions as a respiratory organ.
<p>Objective 8</p> <p><i>Discuss the differences among species in gestation lengths. Use PPT 2 to illustrate the different lengths.</i></p> <p>☐ PPT 2 – Gestation and Incubation Lengths for Different Species</p>	<p>Determine how gestation and incubation lengths differ among species.</p> <ol style="list-style-type: none"> 1. Cow - 281 day average gestation length with a range of 274 to 290 days 2. Sow - 114 day average gestation length with a range of 112 to 116 days 3. Ewe - 147 day average gestation length with a range of 144 and 151 days 4. Mare - 336 day average gestation length with a range of 330 to 350 days 5. Bitch - 63 day average gestation length with a range of 56 to 70 days 6. Doe - 31 day average gestation length with a range of 30 to 32 days 7. Fowl - vary in incubation length for each species, with chickens averaging 21 days and turkeys averaging 28 days
<p>Application:</p> <p>📄 AS 1 – Gestation and the Reproductive Tract</p>	<p>Answers to “Key Questions” on AS 1</p> <ol style="list-style-type: none"> 1. The cotyledons are the points of attachment between the placenta and the uterus. 2. Answers will vary depending on the reproductive tracts used. 3. Answers will vary depending on the reproductive tracts used. <p>Other activities</p> <ol style="list-style-type: none"> 1. Have an artificial inseminator speak to the class about the procedure. The AI method should be demonstrated, either on a model or a real animal. Students may practice the procedure on a model. 2. Have a veterinarian demonstrate how to use ultrasonic sound to pregnancy check a sow. If a nearby veterinarian has a real-time ultrasound machine, take students on a field trip to observe its use. 3. Have the students contact a local feed dealer, Extension office, AI technician, or veterinarian to obtain a breeding calendar.
<p>Closure/Summary</p>	<p>Conception, which takes place in the upper third of the</p>

Instructor Directions	Content Outline
	<p>oviduct and in the infundibulum in fowl, marks the beginning of a new life and the start of gestation in mammals and incubation in fowl. Conception may occur due to natural or artificial breeding, and several procedures can be used to determine whether pregnancy has resulted. Gestation has three stages, with gestation lengths varying due to factors such as the breed and age of the mother. During gestation and incubation, embryonic membranes are essential to the survival of the new life.</p>
<p>Evaluation: Quiz</p>	<p>Answers:</p> <ol style="list-style-type: none"> 1. b 2. c 3. c 4. b 5. c 6. a 7. b 8. Conception occurs when a single sperm unites with the egg. The union of the egg and sperm creates a new life called an embryo. 9. Natural breeding involves the cow and bull mating with the bull depositing semen in the vagina. There are two artificial methods used to impregnate a cow, artificial insemination (AI) and embryo transfer (ET). In AI, the semen is collected from the bull. When estrus is detected in the female, the collected semen is artificially inserted into the cow's reproductive tract. In ET, the female releases many eggs during ovulation because of FSH injections. The eggs are fertilized naturally or artificially. Once the eggs are fertilized, the embryos are collected from the cow and transferred to other cows for the pregnancy. 10. Gestation length may be influenced by the mother's age and breed and by individual differences between animals. The weather and the sire may also affect the length of gestation.

Lesson 4: Conception and Gestation

Name: _____

Gestation and the Reproductive Tract

Objective: Compare sow reproductive tracts at various stages of gestation.

Activity Length: 30 minutes

Materials and Equipment:

Four sow reproductive tracts
Long surgical gloves (shoulder length) or palpation sleeves
Knife

Procedure:

1. Put on the gloves.
2. Working in four groups (one for each tract), locate the uterus. Each student should feel for a fetus or cotyledons.
3. Cut open the uterus to examine the size of the fetuses, if present.
4. Examine the dissected reproductive tracts of the other groups.

Key Questions:

1. What are the cotyledons?
2. In which reproductive tract did the fetuses appear to have the longest gestation period?
3. How many fetuses were present in each tract?

EVALUATION

Circle the letter that corresponds to the best answer.

1. Where does conception occur in a sow?
 - a. Ovary
 - b. Oviduct
 - c. Uterus
 - d. Vagina

2. In which pregnancy determination method is an arm inserted into the rectum of a cow?
 - a. Abdominal palpation
 - b. Laboratory methods
 - c. Rectal palpation
 - d. Ultrasonic sound

3. The time between when the hen sits on an egg and its hatching is called _____.
 - a. Conception
 - b. Gestation
 - c. Incubation
 - d. Parturition

4. During what period does the fetus receive nutrients and oxygen from the mother?
 - a. Conception
 - b. Gestation
 - c. Incubation
 - d. Parturition

5. Which stage is referred to as the time of growth?
 - a. Cell division
 - b. Embryonic
 - c. Fetal
 - d. Organ development

6. A sow has an average gestation length of _____ days.
 - a. 114
 - b. 147
 - c. 281
 - d. 336

7. Which part of the embryonic membrane system protects the fetus from shock?
- a. Allantois
 - b. Amniotic fluid
 - c. Chorion
 - d. Umbilical cord

Complete the following short answer questions.

8. What is conception?
9. What natural and artificial methods may be used to impregnate a cow? Describe each of the methods.
10. What five factors may influence gestation length?
- a.
 - b.
 - c.
 - d.
 - e.

Course	Agricultural Science I
Unit	Introduction to Animal Reproduction
Lesson	Parturition
Estimated Time	50 minutes

Student Outcome

Identify the important factors of parturition.

Learning Objectives

1. Describe what parturition is.
2. Identify the physical signs of parturition.
3. Describe the role that hormones play in parturition.
4. List the problems that may occur during parturition.
5. Describe the various malpresentations.
6. List the postpartum management factors for each species.
7. Describe how the birth process for fowl differs from other species.

Grade Level Expectations

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slide
 - PPt 1 – Parturition Presentations of a Calf
2. Activity Sheet
 - AS 1 – Handling Parturition Difficulties
3. *Introduction to Animal Reproduction (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1996.
4. *Introduction to Animal Reproduction Curriculum Enhancement*. University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplemental Information

1. Internet Sites
 - Animal Science Publications. MU Extension. University of Missouri-Columbia. Accessed April 12, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/>.
 - Kvasnicka, B., B. Bruce, and R. Torell. "When Mother Nature Needs a Nudge." *Beef Today*. Accessed June 18, 2007, from <http://www.dqacenter.org/university/moreinfo/rh26.htm>.
 - Neary, M. and K. Hepworth. *Parturition in Livestock*. Purdue University Extension. Purdue University. Accessed June 18, 2007, from <http://www.ces.purdue.edu/extmedia/AS/AS-561-W.pdf>.
 - Wright, B. and D. Kenney. *Foaling and Predicting Foaling Time*. Ontario, Canada. Accessed June 18, 2007, from

-
- http://www.omafra.gov.on.ca/english/livestock/horses/facts/info_foaling.htm.
Van der Molen, W. H. *Laying an Egg*. Accessed June 18, 2007, from
<http://www.afn.org/~poultry/egghen.htm>.
-

Interest Approach



Ask some of the students who have seen a birth to describe what happens. If possible, include a description of a problem birth, comparing it to a normal birth. Explain what happens in the female reproductive tract during birth, relating the information to their examples.

Communicate the Learning Objectives


1. Describe what parturition is.
2. Identify the physical signs of parturition.
3. Describe the role that hormones play in parturition.
4. List the problems that may occur during parturition.
5. Describe the various malpresentations.
6. List the postpartum management factors for each species.
7. Describe how the birth process for fowl differs from other species.

Instructor Directions	Content Outline
Objective 1 <i>Ask students what parturition is. Discuss what occurs within the reproductive tract during parturition.</i>	Describe what parturition is. <ol style="list-style-type: none">1. Parturition is the act of giving birth; it involves hormones and mechanical factors.2. Contractions occur to move the fetus out of the body. Labor involves the dilation of the cervix and the passage of the fetus and the placenta through the birth canal and out of the body through the vulva.
Objective 2 <i>Ask what some of the physical signs of parturition are. Describe the signs of parturition.</i>	Identify the physical signs of parturition. Cow <ol style="list-style-type: none">1. Swollen udder2. Sunken appearance to hips or head of tail3. Enlarged or dropped abdominal area4. Reddened and swollen vulva5. Separation from the herd6. Swollen and leaking teats7. Increased mucus discharge8. Nervousness9. Restless switching back and forth from a standing to a resting position10. Appearance of water bag from the vulva Sow <ol style="list-style-type: none">1. Enlarged abdominal area2. Restlessness3. Attempts to build a nest

Instructor Directions	Content Outline
	<p>4. Swollen vulva 5. Swelling of teats</p> <p>Ewe</p> <p>1. Swollen teats 2. Swollen, slackened vulva 3. Mucus discharge from vulva 4. Restless shifting of position from standing to lying and back</p> <p>Mare</p> <p>1. Swollen udder 2. Shrunken at hips 3. Dropped abdomen 4. Swollen teats 5. Waxing and leaking of teats 6. Swollen, relaxed vulva 7. Separation from other horses 8. Raised tail 9. Frequent urination 10. Excessive sweating 11. Restless changing of position 12. Breaking of water bag</p> <p>Bitch</p> <p>1. Refuses meals 2. Temperature slightly below normal 3. Vomiting 4. Mucus discharge from vulva</p> <p>Doe</p> <p>1. Pulling of fur to line nest 2. Loss of appetite 3. Nervous and excitable</p>
<p>Objective 3</p> <p><i>Identify the hormones involved in parturition and the role they play during birth.</i></p>	<p>Describe the role that hormones play in parturition.</p> <p>1. Parturition begins with decreasing progesterone levels. 2. Estrogen, oxytocin, and relaxin levels increase. 3. Relaxin is produced by the corpus luteum to relax the pelvic muscles, cartilage, and ligaments. 4. Estrogen causes the birth canal to open. 5. Oxytocin from the pituitary, combined with estrogen, causes contractions.</p>

Instructor Directions	Content Outline
	6. Prolactin is secreted by the anterior pituitary before the birth to trigger milk production.
<p>Objective 4</p> <p><i>Ask students what problems may arise during parturition. Discuss different circumstances that may develop into problems.</i></p>	<p>List the problems that may occur during parturition.</p> <p>Large fetus</p> <p>Small pelvic opening</p> <p>Breeding selection</p> <ol style="list-style-type: none"> 1. Large male of a particular breed is bred to a small female of the same breed 2. Male of a large breed is bred to a female of a smaller breed <p>Young mother</p> <p>Torn cervix, vagina, and vulva</p> <p>Prolapse</p> <p>Abnormal fetal position or presentation</p> <p>Uncontrollable fetal bleeding</p> <p>Infection to the mother or newborn from the birthing process</p>
<p>Objective 5</p> <p><i>Ask students to describe the normal presentation of a fetus. Discuss the various malpresentations. Use PPt 1 to illustrate different presentations. Have students complete AS 1 to practice their knowledge.</i></p> <p> PPt 1 – Parturition Presentations of a Calf</p> <p> AS 1 – Handling Parturition Difficulties</p>	<p>Describe the various malpresentations.</p> <p>Ideal presentation for cattle, sheep, horses, dogs, and rabbits - head between the front legs, which leave the birth canal first; fetal pigs - no particular orientation for the birth process</p> <p>Malpresentations</p> <ol style="list-style-type: none"> 1. Backward with hind legs extended 2. Backward with legs retained 3. One or both forefeet retained 4. Head bent backward 5. Upside down 6. Backward and upside down
<p>Objective 6</p>	<p>List the postpartum management factors for each species.</p>

Instructor Directions	Content Outline
<p><i>Ask students to define postpartum management. Discuss the factors involved in postpartum management for the mother and the newborn for each species.</i></p>	<p>Cattle</p> <ol style="list-style-type: none"> 1. Check that the calf is breathing properly. 2. If the mother does not dry the calf by licking, dry it with a cloth. 3. Ensure that the calf nurses. Hand feeding may be necessary. 4. Reduce navel infections by dipping the navel in iodine. 5. The calf should be identified with an ear tag. 6. Make sure the cow has expelled the afterbirth 7. Check for signs of milk fever. <p>Swine</p> <ol style="list-style-type: none"> 1. Check the newborn's breathing. 2. Dry the piglet with a cloth. 3. Make sure the piglet nurses. 4. Remove the umbilical cord. 5. Dip the navel in iodine. 6. Clip the needle teeth of the piglet with side cutters to protect the mother's udder. 7. Dock the piglet's tail. 8. Make sure the afterbirth is expelled. 9. Notch the ears for identification. <p>Sheep</p> <ol style="list-style-type: none"> 1. Check the lamb's respiration. 2. Place the lamb and the mother in a clean pen. 3. Dry the lamb. 4. Warm the lamb. Use heat lamps or warm water if necessary. 5. Make sure the lamb feeds. 6. Cut the navel cord. 7. Use iodine on the navel. 8. Make sure the afterbirth is expelled. 9. Check for signs of milk fever. <p>Horses</p> <ol style="list-style-type: none"> 1. Check the respiration of the foal. 2. Make sure the foal nurses. 3. Cut the navel cord with a clean, dull scissors if it has not broken in five minutes. 4. Dip the navel in iodine. 5. Make sure the afterbirth is expelled within three

Instructor Directions	Content Outline
	<p>hours. If not, call a veterinarian.</p> <ol style="list-style-type: none"> 6. Examine the afterbirth carefully to make sure the entire placenta is expelled. 7. Make sure that the foal has a bowel movement in the first 24 hours. <p>Dogs</p> <ol style="list-style-type: none"> 1. Check the whelp's breathing. 2. Dry the whelp. 3. Ensure that it nurses. 4. Dip the navel in iodine. 5. Make sure the afterbirth is expelled. 6. Check the bitch for eclampsia. <p>Rabbits</p> <ol style="list-style-type: none"> 1. Check for and remove dead newborns. 2. Remove any afterbirth. 3. Check that the rabbits are nursing. 4. Make sure the nest is warm, well-drained, and well ventilated.
<p>Objective 7</p> <p><i>Discuss the differences between the birth processes of fowl and mammals.</i></p>	<p>Describe how the birth process for fowl differs from other species.</p> <p>Hatching - Hatching is breaking out of the egg through the shell. To ensure hatchability, temperature, humidity, and air velocity around developing eggs must be monitored.</p> <p>Proper hatching position - The chick lies on its side along the longest axis of the egg, facing the egg's large end, with its head under its right wing; variations are malpresentations.</p> <p>Care must be provided after hatching.</p> <ol style="list-style-type: none"> 1. Provide proper temperature in the brooder after hatching. 2. Use a brooder guard the first few days to ensure warmth. 3. Provide adequate humidity and space. 4. Control lighting. 5. Check water and feed for consumption.
<p>Application:</p> <p> AS 1 - Handling</p>	<p>Answers to AS 1</p> <ol style="list-style-type: none"> 1. Abnormal - Calf has forefoot retained. Pull it forward

Instructor Directions	Content Outline
Parturition Difficulties	<p>for the calf to exit the birth canal in the normal position.</p> <ol style="list-style-type: none"> 2. Normal - No assistance needed. 3. Abnormal - Head is bent backward. Assist by pushing the fetus back into the uterus and positioning the head between the legs. Pull the legs forward to exit the birth canal. 4. Abnormal - Calf is backward with feet retained. Assist by straightening the hind legs to enter the birth canal. Quickly deliver the calf backward. <p>Other activities Have a veterinarian speak to the class about the birthing process.</p>
Closure/Summary	<p>Parturition is the process of giving birth; it involves both mechanical factors and special hormones. It is important to be able to recognize the physical signs of parturition, as well as problems during birth. A knowledge of proper postpartum care is also vital. Knowledge in each of these areas will help the producer ensure the survival and health of both mother and newborn.</p>
Evaluation: Quiz	<p>Answers:</p> <ol style="list-style-type: none"> 1. c 2. c 3. d 4. b 5. a 6. b 7. a 8. The act of giving birth 9. The answer should include four of the following: swollen udder, sunken appearance at hips or head of tail, enlarged and dropped abdominal area, reddened and swollen vulva, seeking of a spot separate from the herd, swollen and leaking teats, mucus discharge, nervousness and restless shifting, and water bag protruding from the vulva. 10. The fetus moves from the uterus through the birth canal, which includes the cervix and the vagina, and out of the body through the vulva. 11. The embryo lies on its side along the egg's longest axis. The head is tucked under the right wing and faces the

Instructor Directions	Content Outline
	large end of the egg. 12. Abnormal 13. Normal 14. Abnormal 15. Abnormal 16. Abnormal

Lesson 5: Parturition

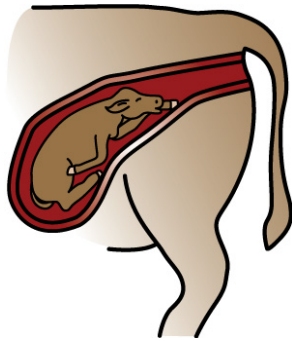
Name: _____

Handling Parturition Difficulties

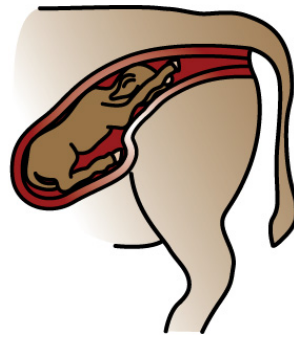
Objective: Identify normal and abnormal presentations of the calf and the appropriate response to malpresentations.

Identify whether each presentation for the calf is normal or abnormal. For each malpresentation, indicate what is wrong and what type of assistance is required, if any.

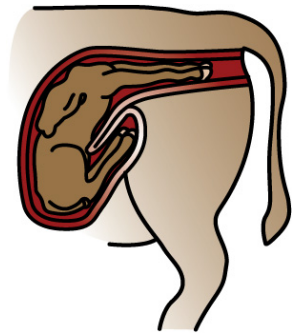
1.



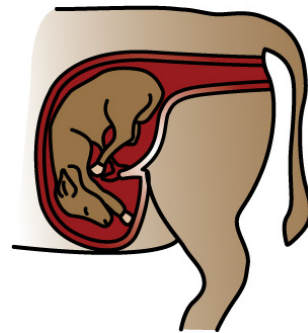
2.



3.



4.



EVALUATION

Circle the letter that corresponds to the best answer.

1. Parturition is initiated by declining levels of _____ from the corpus luteum.
 - a. Estrogen
 - a. Oxytocin
 - b. Progesterone
 - c. Relaxin

2. Relaxin is a hormone that relaxes the _____.
 - a. Birth canal
 - b. Ovary
 - c. Pelvic muscles
 - d. Uterus

3. Which of the following is appropriate care for fowl after hatching?
 - a. Make sure the air is very dry.
 - b. Keep the newly hatched birds cool.
 - c. Give the birds only water for the first few days.
 - d. Use a brooder guard for the first few days.

4. Which of the following may cause a problem during parturition?
 - a. A large female is bred to a small male.
 - b. The female has a small pelvic opening.
 - c. The mother is an older animal.
 - d. The fetus is small.

5. Which hormone is responsible for milk production?
 - a. Prolactin
 - b. Progesterone
 - c. Oxytocin
 - d. Estrogen

6. Which of the following is a postpartum management factor for a newborn calf?
 - a. Using a brooder guard
 - b. Making sure that it nurses
 - c. Clipping needle teeth
 - d. Docking the tail

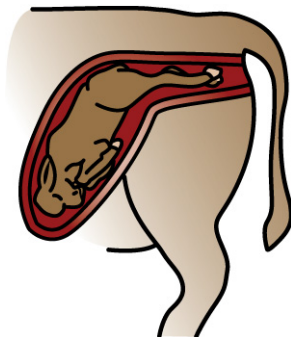
7. Which species may experience eclampsis?
- a. Dogs
 - b. Fowl
 - c. Rabbits
 - d. Swine

Complete the following short answer questions.

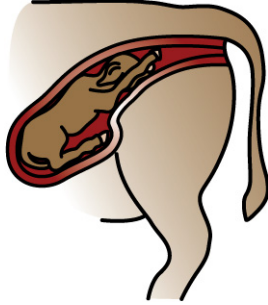
8. What is parturition?
9. What are four physical signs of parturition of a cow?
- a.
 - b.
 - c.
 - d.
10. What is the pathway taken by the fetus during parturition?
11. What is the proper hatching presentation?

Looking at the pictures, indicate on the lines provided whether the presentation is normal or abnormal.

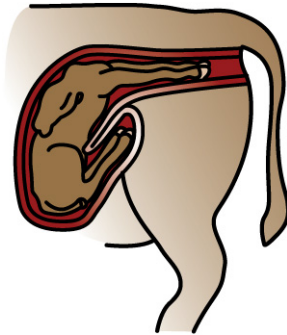
12. _____



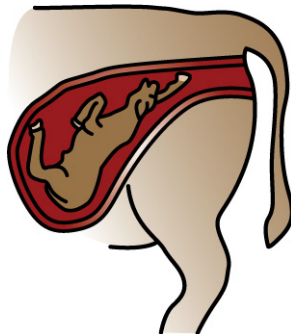
13. _____



14. _____



15. _____



16. _____



Course	Agricultural Science I
Unit	Introduction to Animal Reproduction
Lesson	Reproduction and Genetics
Estimated Time	50 minutes

Student Outcome

Define the role of genetics in reproduction.

Learning Objectives

1. Define what a gene is and describe its function.
2. Define what a chromosome is and describe its function.
3. Describe the relationship between dominant and recessive genes.
4. Describe how the sex of the offspring is determined.

Grade Level Expectations

SC/LO/2/E/09-11/a	SC/LO/3/A/09-11/a	SC/LO/3/B/09-11/a
SC/LO/3/B/09-11/b	SC/LO/3/B/09-11/d	SC/LO/3/C/09-11/b
SC/LO/3/C/09-11/c	SC/LO/3/D/09-11/b	SC/LO/3/D/09-11/c
SC/LO/3/E/09-11/a	SC/LO/3/E/09-11/b	SC/EC/3/C/09-11/a
SC/EC/3/C/09-11/b		

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slide
 - Ppt 1 - Chromosomes and Genes
2. Activity Sheet
 - AS 1 - Determining Genetic Possibilities for Combs in Chickens
3. *Introduction to Animal Reproduction (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1996.
4. *Introduction to Animal Reproduction Curriculum Enhancement*. University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplemental Information

1. Internet Sites
 - Animal Science Publications. MU Extension. University of Missouri-Columbia. Accessed April 12, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/>.
 - Chromosome Numbers of Different Species. Rutgers University. Accessed June 19, 2007, from <http://morgan.rutgers.edu/morganwebframes/level1/page2/ChromNum.html>.
 - DNA, Genes and Chromosomes. ScienceMaster.com. Accessed June 19, 2007, from <http://www.sciencemaster.com/jump/life/dna.php>.
 - Massey, J. W. and D. W. Vogt. *Heritability and Its Use in Animal Breeding*. MU

Extension. University of Missouri-Columbia. Accessed June 18, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02910.htm>.

- ❑ Morris, P. J. Figuring Out How Genes Combine. Athro Limited. Accessed June 19, 2007, from <http://www.athro.com/evo/gen/punnett.html>.
 - ❑ O'Neil, D. Probability of Inheritance. Palomar College. Accessed June 18, 2007, from http://anthro.palomar.edu/mendel/mendel_2.htm.
 - ❑ Sex Chromosomes. Accessed June 19, 2007, from <http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/S/SexChromosomes.html>.
 - ❑ Vogt, D., H. A. Swartz, and J. Massey. *Inbreeding: Its Meaning, Uses and Effects on Farm Animals*. MU Extension. University of Missouri-Columbia. Accessed June 18, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02911.htm>.
-


Interest Approach

1. Ask students to guess what the color of the foal will be if a black mare is bred to a brown stallion. Ask what determines the foal's coat color. Discuss the role of genetics in coat color in horses. Give examples of possible coat colors for a foal with parents of different colors.
2. Ask students if they know why mules cannot reproduce. Point out that the cause of their sterility is genetic, since a mule is the offspring of a donkey, which has 62 chromosomes (31 pairs), and a horse, which has 64 chromosomes (32 pairs). The mule therefore has 63 chromosomes and is infertile.

Communicate the Learning Objectives

1. Define what a gene is and describe its function.
2. Define what a chromosome is and describe its function.
3. Describe the relationship between dominant and recessive genes.
4. Describe how the sex of the offspring is determined.

Instructor Directions	Content Outline
Objective 1 <i>Ask students what a gene is. Describe the gene's role in reproduction.</i>	Define what a gene is and describe its function. <ol style="list-style-type: none">1. Gene - unit of inheritance carrying traits inheritable by offspring through reproduction2. Deoxyribonucleic acid (DNA) - component of the gene that controls inheritance
Objective 2 <i>Discuss chromosomes and their functions. Use PPT 1 to give students an idea of what is included on a chromosome. Discuss how many chromosomes are present in each species. Compare the number of chromosome pairs present in human beings (23) to the number of pairs found in the animal species covered below.</i> <input type="checkbox"/> PPT 1 - Chromosomes and Genes	Define what a chromosome is and describe its function. Chromosomes are found in the nucleus of the cell. They carry the genes. Chromosomes occur in pairs. Offspring inherit one chromosome from each pair of the parent through the reproductive cells, which have single rather than paired chromosomes. Genetic material from each parent is thus combined in the offspring. The number of chromosomes varies among species. <ol style="list-style-type: none">1. Cattle - 60 chromosomes, 30 pairs2. Swine - 38 chromosomes, 19 pairs3. Sheep - 54 chromosomes, 27 pairs4. Fowl (poultry) - 78 chromosomes, 39 pairs5. Horses - 64 chromosomes, 32 pairs6. Dogs - 78 chromosomes, 39 pairs7. Rabbits - 44 chromosomes, 22 pairs
Objective 3	Describe the relationship between dominant and recessive genes.

Instructor Directions	Content Outline									
<p><i>Ask students what dominant means. Ask them what recessive means. Discuss the difference between the two and their relation to genes. Illustrate the dominant and recessive gene relationship in horned and polled cattle. Have students complete AS 1.</i></p> <p> AS 1 – Determining Genetic Possibilities for Combs in Chickens</p>	<p>Dominant gene - gene that hides another gene's characteristic</p> <p>Recessive gene - gene associated with a trait that is suppressed by another gene</p> <p>Dominance in polled and horned genes in cattle</p> <p>Polled characteristic - dominant (A)</p> <ol style="list-style-type: none"> Horned - recessive (a) Punnet square of Aa and Aa cross <table border="1" data-bbox="802 701 972 873" style="margin-left: 40px;"> <tr> <td></td> <td>A</td> <td>a</td> </tr> <tr> <td>A</td> <td>AA</td> <td>Aa</td> </tr> <tr> <td>a</td> <td>Aa</td> <td>aa</td> </tr> </table> Heterozygous - carrying two different genes for a characteristics (Aa); homozygous - carrying identical genes for a characteristic (AA, aa) Phenotype - animal's observable characteristics (phenotypic ratio - 3:1) Genotype - actual genetic makeup (genotypic ratio - 1:2:1) 		A	a	A	AA	Aa	a	Aa	aa
	A	a								
A	AA	Aa								
a	Aa	aa								
<p>Objective 4</p> <p><i>Discuss how the sex of offspring is determined through genetics. Ask what the determining factor for sex in the offspring is.</i></p>	<p>Describe how the sex of the offspring is determined.</p> <ol style="list-style-type: none"> The female chromosome in most species is X, with the female chromosome pair being XX. The male chromosome is Y in most species, with the male chromosome pair being XY. The newborn's sex depends on whether the male's X or Y chromosome matches with the female's X gene when the egg is fertilized. The male determines the sex of offspring. In fowl, the female determines the sex. The female has two different sex chromosomes (ZW), while the male's (WW) are the same. 									

Instructor Directions	Content Outline																		
<p>Application:</p> <p>AS 1 – Determining Genetic Possibilities for Combs in Chickens</p>	<p>Answers to AS 1</p> <p>1.</p> <table border="1" data-bbox="808 289 1027 453"> <tr> <td></td> <td>r</td> <td>r</td> </tr> <tr> <td>r</td> <td>rr</td> <td>rr</td> </tr> <tr> <td>r</td> <td>rr</td> <td>rr</td> </tr> </table> <p>Genotypic ratio – 4:0, phenotypic ratio – 4:0</p> <p>2.</p> <table border="1" data-bbox="808 520 1027 684"> <tr> <td></td> <td>R</td> <td>R</td> </tr> <tr> <td>R</td> <td>RR</td> <td>RR</td> </tr> <tr> <td>r</td> <td>Rr</td> <td>Rr</td> </tr> </table> <p>Genotypic ratio – 1:1, phenotypic ratio – 4:0</p> <p>Other activities</p> <ol style="list-style-type: none"> 1. Have students examine incomplete dominance in more detail by doing a Punnet square to determine the possibilities for coat color in shorthorn cattle with a red bull and a white cow. Then have the students complete a Punnet square for a roan bull and a white cow. 2. Have students examine themselves and their parents for dominant and recessive traits. Recessive traits include the ability to roll the tongue, attached ear lobes, hitchhiker's thumb, and no hair on the middle segment of fingers. 		r	r	r	rr	rr	r	rr	rr		R	R	R	RR	RR	r	Rr	Rr
	r	r																	
r	rr	rr																	
r	rr	rr																	
	R	R																	
R	RR	RR																	
r	Rr	Rr																	
<p>Closure/Summary</p>	<p>Genes are units of inheritance that are carried on paired chromosomes. The relationship of the genes inherited by offspring determines its characteristics and sex.</p>																		

Instructor Directions	Content Outline									
<p>Evaluation: Quiz</p>	<p>Answers:</p> <ol style="list-style-type: none"> 1. d 2. b 3. c 4. c 5. d 6. The female contributes an X chromosome since its sex chromosome pair is XX. The male determines the sex, since its chromosome pair is XY and it can contribute either an X or a Y chromosome. 7. Genotype is the actual genetic makeup of an animal. Phenotype is the observed characteristics of the animal. 8. <table border="1" data-bbox="779 745 1036 928" style="margin-left: 40px;"> <tr> <td></td> <td style="text-align: center;">b</td> <td style="text-align: center;">b</td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">Bb</td> <td style="text-align: center;">Bb</td> </tr> <tr> <td style="text-align: center;">b</td> <td style="text-align: center;">bb</td> <td style="text-align: center;">bb</td> </tr> </table> 9. Two, two 10. 1:1 or 2:2; 1:1 or 2:2 		b	b	B	Bb	Bb	b	bb	bb
	b	b								
B	Bb	Bb								
b	bb	bb								

Lesson 6: Reproduction and Genetics

Name _____

Determining Genetic Possibilities for Combs in Chickens

Objective: Determine the relationship between dominant and recessive genes using the Punnet square.

Fill out a Punnet square to determine the genetic possibilities for the inheritance of combs in chickens.

Key Questions:

In chickens, a rose comb is dominant and a single comb is recessive. The gene for the rose comb is represented by R, and r represents the gene for the single comb.

1. What would the offspring be if a single comb male mates with a single comb female?

What is the genotypic ratio? _____

What is the phenotypic ratio? _____

2. What would the offspring be if a rose comb male mates with a rose comb female that is known to possess the single comb gene?

What is the genotypic ratio? _____

What is the phenotypic ratio? _____

EVALUATION

Circle the letter that corresponds to the best answer.

1. What is the unit of inheritance?
 - a. Cell nucleus
 - b. Chromosome
 - c. Deoxyribonucleic acid
 - d. Gene

2. What is the long, slender, threadlike structure used to carry inheritance?
 - a. Cell nucleus
 - b. Chromosome
 - c. DNA
 - d. Gene

3. A dog that has 39 chromosome pairs has _____ chromosomes.
 - a. 39
 - b. 58
 - c. 78
 - d. 117

4. For most species, what is the normal sex chromosome combination of the male animal?
 - a. XX
 - b. XXY
 - c. XY
 - d. YY

5. What is a trait that is suppressed by another gene called?
 - a. Dominant
 - b. Genotype
 - c. Phenotype
 - d. Recessive

Complete the following short answer questions.

6. How is an offspring's sex determined in mammals?

7. What is genotype? What is phenotype?

Fill out a Punnet square to answer the following questions.

In cattle, black coat color is dominant over red. The black gene is represented with a B and the red gene with a b. A cow has a gene pair of Bb, while the bull's is bb.

8. What is the Punnet square for coat color for the offspring of the bull and cow?
9. Of the four possibilities, how many calves would be red? How many would be black?
10. What is the genotypic ratio? What is the phenotypic ratio?

Course	Agricultural Science I
Unit	Introduction to Animal Reproduction
Lesson	Genetic Improvement Management Practices
Estimated Time	50 minutes

Student Outcome

Compare management practices for genetic improvement.

Learning Objectives

1. Identify management practices that can be used for genetic improvement.
2. Describe the various kinds of breeding systems.
3. List the advantages and disadvantages of artificial insemination.
4. List the advantages and disadvantages of embryo transfer.

Grade Level Expectations

SC/LO/3/D/09-11/a	SC/LO/3/D/09-11/b	SC/LO/3/D/09-11/c
SC/EC/3/C/09-11/b	SC/EC/3/C/09-11/c	SC/ST/1/C/09-11/a
SC/ST/3/B/09-11/a	SC/ST/3/B/09-11/b	SC/ST/3/B/09-11/c

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. Activity Sheet
 - ☞ AS 1 – Selecting a Boar for Breeding
2. *Introduction to Animal Reproduction (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1996.
3. *Introduction to Animal Reproduction Curriculum Enhancement*. University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplemental Information

1. Internet Sites
 - ☐ Animal Science Publications. MU Extension. University of Missouri-Columbia. Accessed April 12, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/>.
 - ☐ Massey, J. *Culling the Commercial Cow Herd: BIF Fact Sheet*. MU Extension. University of Missouri-Columbia. Accessed June 19, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02036.htm>.
 - ☐ Seidel, Jr., G. E. and S. M. Seidel. *Training Manual for Embryo Transfer in Cattle*. Colorado State University. Accessed June 19, 2007, from <http://www.fao.org/DOCREP/004/T0117E/T0117E00.htm#TOC>.
 - ☐ Selk, G. *Embryo Transfer in Cattle*. OSU Cooperative Extension. Oklahoma State University. Accessed June 19, 2007, from <http://osuextra.okstate.edu/pdfs/F-3158web.pdf>.
 - ☐ Sterle, J. and T. Safranski. *Artificial Insemination in Swine: Breeding the Female*. MU

Extension. University of Missouri-Columbia. Accessed June 19, 2007, from <http://extension.missouri.edu/explore/agguides/ansci/g02312.htm>.


- Webb, D. W. *Artificial Insemination in Dairy Cattle*. IFAS Extension. University of Florida. Accessed June 19, 2007, from <http://edis.ifas.ufl.edu/DS089>.
-

Interest Approach


Ask the students to imagine that they are showing a lamb in a market lamb show at the county fair with 20 lambs in the class. The judge places the class, and the lamb comes in 15th place. The lamb is correctly placed, since it has less muscling, size, and overall appeal than those placed ahead of it. For the county fair next year, the students want to breed a better market lamb and place higher in the class. Ask the students how they are going to improve next year's market lamb. Have the students realize that in order to have a better market lamb they need to know the various genetic improvement management practices.

Communicate the Learning Objectives

1. Identify management practices that can be used for genetic improvement.
2. Describe the various kinds of breeding systems.
3. List the advantages and disadvantages of artificial insemination.
4. List the advantages and disadvantages of embryo transfer.

Instructor Directions	Content Outline
<p>Objective 1</p> <p><i>Ask students to name some genetic management practices. Describe the various practices that can be used to improve the genetics of the market lamb. Have students complete AS 1.</i></p> <p> AS 1 - Selecting a Boar for Breeding</p>	<p>Identify management practices that can be used for genetic improvement.</p> <p>Genetic selection</p> <ol style="list-style-type: none">1. Tandem selection - selecting breeding stock for one or two traits2. Culling - removing less desirable traits by removing individuals with those traits from a breeding program3. Selection index - comparing the possible animals for breeding by using a scoring system in which the animal with the lowest number based on the criteria of the index is selected for breeding <p>Evaluation of pedigrees, individual appearances, performance records, and progeny tests (which cannot be used for a young sire)</p> <p>Artificial insemination - improves genetics through sire selection</p> <p>Embryo transfer - improves genetics through selection of the female</p>
<p>Objective 2</p> <p><i>Ask the student what is meant by a breeding system. Discuss the responses and describe a breeding system. Describe the two main</i></p>	<p>Describe the various kinds of breeding systems.</p> <p>Straight breeding - mating animals of the same breed</p> <ol style="list-style-type: none">1. Purebred breeding system - both parents purebred and of the same breed

Instructor Directions	Content Outline
<p><i>breeding systems and what they entail.</i></p>	<ol style="list-style-type: none"> 2. Inbreeding - mating of animals that are more closely related than the average of the population using either close breeding or line breeding to improve genetic purity 3. Outcrossing - mating of parents from the same breed but different families to bring in new traits 4. Grading up (upgrading) - breeding of a non-registered, or grade, female to a purebred male <p>Crossbreeding - mating of two animals from different breeds</p> <ol style="list-style-type: none"> 1. Two-breed cross - mating of a male and female from two different breeds 2. Three-breed cross - mating of a crossbred female to a male of a different breed 3. Rotational cross - using males of different breeds for several succeeding generations of females, ending with a male of the same breed as the first female used and then repeating the series 4. Backcrossing - mating a crossbred female to a male of one of the same breeds of the female
<p>Objective 3</p> <p><i>Review the procedure used in AI. Have the students write down what they think one advantage and one disadvantage of artificial insemination might be. Ask them what they wrote down and discuss the advantages and disadvantages of artificial insemination.</i></p>	<p>List the advantages and disadvantages of artificial insemination.</p> <p>Advantages</p> <ol style="list-style-type: none"> 1. Allows extensive use of outstanding sires to improve genetics 2. Produces more offspring than natural mating since semen from one collection can be frozen and stored 3. Allows injured sires to be used in a breeding program 4. Controls diseases 5. Makes traditional sire ownership unnecessary 6. May lower sire costs <p>Disadvantages</p> <ol style="list-style-type: none"> 1. Requires careful handling and storage of semen 2. Cannot refreeze semen that has been thawed, since sperm cells are destroyed 3. Requires additional management practices and facilities and more time and labor to ensure pregnancy 4. Requires special training to perform the procedure 5. May overly stress females
<p>Objective 4</p>	<p>List the advantages and disadvantages of embryo transfer.</p>

Instructor Directions	Content Outline
<p><i>Have students list some advantages and disadvantages of embryo transfer for a breeding program. Discuss the advantages and disadvantages.</i></p>	<p>Advantages</p> <ol style="list-style-type: none"> 1. Allows a greater use of superior females to improve genetics 2. Can freeze collected embryos and keep them dormant for months or years 3. Can mechanically divide an embryo so identical twins can be produced 4. Allows females that are unable to produce offspring themselves due to some condition to be used in a breeding program <p>Disadvantages</p> <ol style="list-style-type: none"> 1. Requires extensive management to perform 2. Requires special management for estrous synchronization to transfer the embryo to the host female 3. Requires the producer to keep more stock, with several recipients for every donor female, which increases costs 4. Expense of the process 5. Has a lower confirmed pregnancy rate for frozen embryos 6. May require surgery if the embryos cannot be removed from the donor female
<p>Application:</p> <p> AS 1 - Selecting a Boar for Breeding</p>	<p>Answers to AS 1</p> <ol style="list-style-type: none"> 1. Leanness and the number of days to 230 2. Boar 1 3. Boar 1 4. Boar 2 5. Boar 1 <p>Other activities</p> <ol style="list-style-type: none"> 1. Have students select the best sire for a breeding system for a cow-calf operation that raises purebred beef. Give students a cow herd and a choice between two bulls and have them select the bull for the breeding program. 2. Visit a producer who practices estrous synchronization and embryo transfer. Have him or her discuss the management practices required.
<p>Closure/Summary</p>	<p>Genetic improvement management practices involve the</p>

Instructor Directions	Content Outline
	<p>selection or rejection of an animal for breeding based on an evaluation of the animal. Breeding systems consisting of straight breeding and crossbreeding can be used to improve the genetic makeup of offspring. Artificial breeding techniques such as AI and ET can also improve stock genetically, although their use has both advantages and disadvantages.</p>
<p>Evaluation: Quiz</p>	<p>Answers:</p> <ol style="list-style-type: none"> 1. a 2. a 3. a 4. c 5. b 6. d 7. Straight breeding is breeding animals of the same breed. The purpose is to keep purebred stock for commercial producers. Crossbreeding is the mating of two animals that are of different breeds. Many breeders use this system to attain hybrid vigor, with the offspring being superior to the average of the parents. Crossbreeding also results in animals that combine desirable traits not found in any one breed. 8. Answers should include three of each of the following advantages and disadvantages. <p>Advantages</p> <ul style="list-style-type: none"> • Extensive use of outstanding sires • Storage of semen for later use • Use of injured sires in a breeding program • Control of diseases • Makes traditional sire ownership unnecessary • May lower sire costs <p>Disadvantages</p> <ul style="list-style-type: none"> • Difficulty of handling and storage • Sperm cells destroyed when semen is thawed • Additional management practices and facilities and more time and labor needed to ensure pregnancy • Requires special training to perform the procedure correctly • May overly stress females

Instructor Directions	Content Outline
	<p>9. Answers should include three of each of the following advantages and disadvantages.</p> <p>Advantages</p> <ul style="list-style-type: none"> • Greater use of outstanding females • Storage of frozen embryos for the producer's later use • Splitting of embryos to create identical twins • Use of superior females that have some condition that prevents them from producing their own offspring <p>Disadvantages</p> <ul style="list-style-type: none"> • Requires extensive management • Necessitates special management for estrous synchronization • Increased costs due to keeping more stock to serve as hosts for embryo transfer • Cost of the process itself • Low pregnancy rate when using frozen embryos • May require surgery to extract embryos

Lesson 7: Genetic Improvement Management Practices

Name _____

Selecting a Boar for Breeding

Objective: Given two boars and one sow, select a boar to improve market hog genetics.

Using the descriptions provided below, identify the sow's strengths and weaknesses in each of the three categories of breed, physical traits, and performance records. Then identify each boar's strengths and weaknesses in the three categories. Determine which breeding system to use. Match the best boar with the sow to improve market hog genetics.

Sow	Boar 1	Boar 2
Breed - Yorkshire Backfat - 0.44 inches Loin eye area - 6.45 inches Days to 230 - 165 Lean - 63.5%	Breed - Duroc Backfat - 0.44 inches Loin eye area - 5.35 inches Days to 230 - 151 Lean - 55.1%	Breed - Hampshire Backfat - 0.58 inches Loin eye area - 7.1 inches Days to 230 - 160 Lean - 61.1%

- List the weaknesses of the sow that will be improved upon through breeding.
- Which boar is leanest?
- Which boar has the fewest days to 230?
- Which boar has the largest loin eye area?
- Which boar will be used in the breeding program?

EVALUATION

Circle the letter that corresponds to the best answer.

1. Which management practice eliminates less desirable traits by removing animals from the breeding program?
 - a. Culling
 - b. Embryo transfer
 - c. Selection index
 - d. Tandem

2. Which of the following is not used when evaluating a young sire to determine whether to include it in a breeding program?
 - a. Genetic selection index
 - b. Pedigree
 - c. Performance record
 - d. Progeny test

3. What management practice allows for the greater improvement of offspring genetics through sire selection?
 - a. Artificial insemination
 - b. Culling
 - c. Embryo transfer
 - d. Pedigree evaluation

4. What is the name of the breeding system that includes outcrossing?
 - a. Crossbreeding
 - b. Inbreeding
 - c. Straight breeding
 - d. Three-breed cross

5. What is the type of breeding used when related animals are bred to maintain a close genetic relationship to an outstanding ancestor?
 - a. Closebreedng
 - b. Line breeding
 - c. Outcrossing
 - d. Purebred

6. What is the breeding system used when a female from one breed is bred to a male of another breed?
- a. Backcrossing
 - b. Hybrid vigor
 - c. Three-breed cross
 - d. Two-breed cross

Complete the following short answer questions.

7. What is the difference between straight breeding and crossbreeding? What is the purpose of each?

8. What are three advantages and three disadvantages of artificial insemination?

Advantages

a.

b.

c.

Disadvantages

d.

e.

f.

9. What are three advantages and three disadvantages of embryo transfer?

Advantages

a.

b.

c.

Disadvantages

a.

b.

c.

Agricultural Science I

Curriculum Guide: *Introduction to Animal Reproduction*

Unit Objective:

Students will demonstrate an understanding of the principles of animal reproduction by summarizing the advantages and disadvantages of a common breeding method and presenting their findings on a poster that will be displayed in class.

Show-Me Standards: 3.7, SC3

References:

Advanced Livestock Production and Management. University of Missouri-Columbia, Instructional Materials Laboratory, 2000.

FBMA Beef Management (CD). University of Missouri-Columbia, Farm Business Management Analysis, 2001.

FBMA Horse Management for Adults (CD). University of Missouri-Columbia, Farm Business Management Analysis, 2002.

Introduction to Animal Reproduction. University of Missouri-Columbia, Instructional Materials Laboratory, 1996.

Lamberson, B., Massey, J., & Whittier, J. C. *Crossbreeding Systems for Small Herds of Beef Cattle*. University of Missouri-Columbia. Accessed May 1, 2003, from <http://muextension.missouri.edu/explore/agguides/ansci/g02040.htm>.

Sterle, J., & Safranski, T. *Artificial Insemination in Swine: Breeding the Female*. University of Missouri-Columbia. Accessed May 1, 2003, from <http://muextension.missouri.edu/explore/agguides/ansci/g02312.htm>.

Vogt, D., Swartz, H. A., & Massey, J. *Inbreeding: Its Meaning, Uses and Effects on Farm Animals*. University of Missouri-Columbia. Accessed May 1, 2003, from <http://muextension.missouri.edu/explore/agguides/ansci/g02911.htm>.

Students may use additional outside sources to complete this activity.

Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 through 7.
- Students will complete AS 1.1, Reproductive System of the Bull; AS 1.2, Dissection of a Testicle; AS 2.1, Reproductive System of the Cow; AS 2.2, Dissection of a Female Reproductive Tract; AS 3.1, Gathering Breeding Age Information; and AS 4.1, Gestation and the Reproductive Tract.
- Additional activities that relate to the unit objective can be found under the heading “Other Activities” in the following locations: p. 35, p. 81 (1), and p. 125 (2).

Performance-Based Assessment:

Students will work in groups to determine the advantages and disadvantages of a common method of breeding livestock, such as straight breeding, crossbreeding, artificial insemination, or embryo transfer, and present their findings on a poster that will be displayed in class.

Assessment will be based on the overall content and presentation of the poster. At the instructor’s discretion, students will contribute to the assessment by providing a brief evaluation of the performance of the other members of their group.

Introduction to Animal Reproduction Instructor Guide

The instructor should assign the performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

1. Perform any relevant activities or demonstrations prior to the due date for the performance-based assessment so that students can incorporate material discussed or assigned during these activities in their performance-based assessment project.
2. Divide the class into groups and assign each group a common method of breeding livestock discussed in the unit, such as straight breeding, crossbreeding, artificial insemination, or embryo transfer.
3. Have the groups determine the advantages and disadvantages of their assigned breeding method and present their findings on a poster, which will be displayed in class. Have students list their assigned breeding method at the top of their poster and include a brief explanation of the method.
4. Students may use material in the unit as well as additional outside material to complete their poster.
 - a. Students may not use the source material word for word and must provide a complete bibliography of their sources along with their poster.
 - b. Students should incorporate additional supporting material, such as diagrams, illustrations, or information from class demonstrations, as needed to make the poster interesting and informative.
5. If desired, have students contribute to the assessment process by completing a short evaluation of their teammates' performance in developing their poster. A peer evaluation form is included following the scoring guide.
 - a. Have students complete the peer evaluation form by following the instructions listed at the top. Students should base their assessment on how much each person contributed to the project.
 - b. If tasks are divided so that students do only one type of task to contribute to the project, have students adjust their peer evaluation form by disregarding the category that does not apply to a particular teammate. Instead of assessing teammates on two categories worth 0 to 3 points, students will assess teammates on one category worth 0 to 6 points.

- c. To determine the final peer evaluation score, add up the scores that a student receives from the other members of the group and divide the total by the number of scores received. The maximum number of points possible for each student is 6.
6. The final assessment score will be based on the overall content and presentation of the poster.

Introduction to Animal Reproduction Student Handout

1. The instructor will divide the class into groups and assign each group a common method used for breeding livestock.
2. Determine the advantages and disadvantages of your assigned breeding method.
3. Present your findings on a poster, which will be displayed in class. Include the name of your assigned breeding method and a brief explanation at the top of your poster.
4. You may use material in the unit as well as additional outside material to complete your poster.
 - a. You may not use the source material word for word and must provide the instructor with a complete bibliography of your sources along with your poster.
 - b. Incorporate additional supporting material, such as diagrams, illustrations, or information from class demonstrations or activities, as needed to make the poster interesting and informative.
5. If requested, you will contribute to the assessment process by completing a short evaluation of your teammates' performance in developing the poster.
 - a. After your poster has been completed, fill out the peer evaluation score sheet.
 - b. Give the completed score sheet to your instructor.
6. Your final assessment score will be based on the overall content and presentation of your poster.

Agricultural Science I

Introduction to Animal Reproduction Scoring Guide

Name _____

Assessment Area	Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Thoroughness	Poster provides all of the major advantages and disadvantages of the assigned breeding method	Failed	Poor	Fair	Good	Excellent	X 10	
Accuracy	Facts are accurate	Failed	Poor	Fair	Good	Excellent	X 7.5	
Presentation	Poster is well organized and eye-appealing	Failed	Poor	Fair	Good	Excellent	X 3.5	
Technical Considerations	Spelling, grammar, and punctuation are correct	Failed	Poor	Fair	Good	Excellent	X 2.5	
Peer Evaluation							6 pts. maximum	
TOTAL								

◆ Page 7 ◆

Final Assessment Total _____/100 pts.

Comments:

**Introduction to Animal Reproduction
Peer Evaluation**

Name _____

Write your name on the line above. Fill in the names of your teammates in the spaces provided below. For each category listed below, give each teammate a score from 0 to 3 based on his or her contribution to the project. Use the following guide.

- 0 – no contribution
- 1 – minimal contribution
- 2 – average contribution
- 3 – excellent contribution

Add the person's score in each category and place the total in the column at the right. Give the completed score sheet to your instructor.

Project development includes tasks such as planning and research. Project completion includes writing, assembling, or presenting the project. If tasks are divided so that you or your teammates do only one type of task to contribute to the project, consult the instructor about how to adjust your evaluation form.

Name of Teammate	Project Development 0-3 Points	Project Completion 0-3 Points	Total (6 Points Max.)

