

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>.
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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>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.</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> <p>1. Horned - recessive (a)</p> <p>2. Punnet square of Aa and Aa cross</p> <table><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> <p>3. Heterozygous - carrying two different genes for a characteristics (Aa); homozygous - carrying identical genes for a characteristic (AA, aa)</p> <p>4. Phenotype - animal's observable characteristics (phenotypic ratio - 3:1)</p> <p>5. Genotype - actual genetic makeup (genotypic ratio - 1:2:1)</p>		A	a	A	AA	Aa	a	Aa	aa
	A	a								
A	AA	Aa								
a	Aa	aa								
<p>Objective 4</p> <p>Discuss how the sex of offspring is determined through genetics. Ask what the determining factor for sex in the offspring is.</p>	<p>Describe how the sex of the offspring is determined.</p> <p>1. The female chromosome in most species is X, with the female chromosome pair being XX.</p> <p>2. The male chromosome is Y in most species, with the male chromosome pair being XY.</p> <p>3. 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.</p> <p>4. In fowl, the female determines the sex. The female has two different sex chromosomes (ZW), while the male's (WW) are the same.</p>									

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><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><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> <p>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.</p> <p>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.</p>		r	r	r	rr	rr	r	rr	rr		R	R	R	RR	RR	r	Rr	Rr
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<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									
Evaluation: Quiz	<p>Answers:</p> <ol style="list-style-type: none">1. d2. b3. c4. c5. d6. 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><tr><td></td><td>b</td><td>b</td></tr><tr><td>B</td><td>Bb</td><td>Bb</td></tr><tr><td>b</td><td>bb</td><td>bb</td></tr></table>9. Two, two10. 1:1 or 2:2; 1:1 or 2:2		b	b	B	Bb	Bb	b	bb	bb
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