

Advanced Animal Genetics

Lesson Overview

Media: Video (38 minutes)

Seat Time: 4 Classes | 200 minutes teaching

Goal:

To gain an understanding of the structures and processes related to genetics and how they impact the livestock industry.

Description:

This presentation explores the fundamental principles of heredity and variation. Terms such as cell, chromosomes, DNA and RNA are defined and described to aid in the understanding of the genetic process. Detailed graphics and illustration of topics, such as the process of meiosis and mitosis, will increase comprehension of the more advanced genetic concepts. The history of inheritance is also discussed, as well as the use of technology to improve genetic outcomes and to benefit the livestock industry.

Objectives:

1. To understand the structure of DNA and RNA.
2. To identify and comprehend the processes related to cell division.
3. To explore the importance of animal genetics and the role it plays in the livestock industry.

Lesson Plan

Class 1

Class Overview:

- Segment 1:
 - *Introduction* Video Segment
 - *Basic Structures* Video Segment
 - *Chromosomes* Video Segment
 - *Alleles* Video Segment
 - *DNA & RNA* Video Segment
 - *Cell Division* Video Segment
- Action Plan
- Vocabulary Handout
- Key Concepts
- Segment 1 Check for Understanding
- Animal Cell Diagram Activity
- DNA Model Project

Essential Questions:

1. What are genetics?
2. How does the study of genetics affect animals in agriculture?
 1. What are the structures of a cell?
 2. What are chromosomes and what role do they play?
 3. How do alleles contribute to genetics?
 4. What are DNA and RNA?
 1. What is mitosis?
 2. What role does mitosis play in animal genetics?

Step 1: Bell Ringer:



- Have students write down their definition of the word genetics. Lead a class discussion to share their responses.



NOTE: If you see this icon, the item is available to be completed interactively on iCEV.

Advanced Animal Genetics

Lesson Plan

Class 1 (continued)

Step 2: Distribute the **Action Plan**, **Vocabulary Handout** and **Key Concepts**.



- The **Action Plan** lays out a list of tasks for students to complete during the lesson.
- The **Vocabulary Handout** is a list of terms used throughout the lesson.
- The **Key Concepts** is an outline which identifies the main ideas presented in the lesson which students can fill in to aid in note taking during the lesson.

Step 3 Show the **Segment 1: Introduction, Basic Structures, Chromosomes, Alleles, DNA & RNA, Cell Division** video segments.



- These videos are a total of 16 minutes long.
- Be sure students utilize the **Key Concepts** for this segment of the lesson.

Step 4: Administer the **Segment 1 Check for Understanding**.



- The Check for Understanding is a short review of the content presented in the segment.

Step 5: Students should complete the **Animal Cell Diagram Activity**.



- Students will recognize and understand the organelles in an animal cell by labeling and coloring each one and defining its function.

Step 6: Students should begin the **DNA Model Project**.



- Students will create a DNA model to represent the shape of DNA and the processes of translation, transcription and mutation.

Step 7: Exit Ticket:



- Have students revise their definition of genetics, if necessary, and turn in.

Class 2

Class Overview:

- Segment 2:
 - *Meiosis Overview* Video Segment
 - *Phase I* Video Segment
 - *Phase II* Video Segment
 - *Mendel's Law of Inheritance* Video Segment
 - *Dominant & Recessive Genes* Video Segment
 - *Heredity* Video Segment
- Action Plan
- Key Concepts
- Segment 2 Check for Understanding
- Comparison of Mitosis & Meiosis Activity
- Comparison of DNA & RNA Activity
- Heritable Traits Project

Essential Questions:

1. What is meiosis?
2. How is meiosis important to animal genetics?
 1. What is the significance of Mendel's Laws of Inheritance?
 2. How do dominant and recessive genes differ?
3. What is heredity?



NOTE: If you see this icon, the item is available to be completed interactively on iCEV.

Advanced Animal Genetics

Lesson Plan

Class 2 (continued)

Step 1: Bell Ringer:



- Have students answer the **Essential Questions** without using outside resources.

Step 2: Show the **Segment 2: Meiosis Overview, Phase I, Phase II, Mendel's Law of Inheritance, Dominant & Recessive Genes, Heredity** video segments.



- These videos are a total of 12 minutes long.
- Be sure students utilize the **Key Concepts** for this segment of the lesson.

Step 3: Administer the **Segment 2 Check for Understanding**.



- The Check for Understanding is a short review of the content presented in the lesson.

Step 4: Students should complete the **Comparison of Mitosis & Meiosis Activity**.



- Students will record the similarities and differences of mitosis and meiosis based on different stages of cell activity.

Step 5: Students should complete the **Comparison of DNA & RNA Activity**.



- Students will record the similarities and differences of DNA and RNA in a Venn diagram.

Step 6: Students should complete the **Heritable Traits Project**.



- Students will create an animal by applying their knowledge of dominant and recessive genes and Punnett squares within advanced genetics.

Step 7: Exit Ticket:



- Students should revise their answers to the **Essential Questions**, if necessary, and turn in.

Class 3

Class Overview:

- Segment 3:
 - *Sex Determination* Video Segment
 - *Animal Selection* Video Segment
 - *EPD* Video Segment
 - *Mutations* Video Segment
 - *Improvements* Video Segment
 - *Conclusion* Video Segment
- Action Plan
- Key Concepts
- Segment 3 Check for Understanding
- Genetics Lab Activity

Essential Questions:

1. How do genetics determine sex determination?
2. How do genetics contribute to animal selection?
3. How do Expected Progeny Differences (EPDs) assist producers?
4. Why do mutations occur?
5. How has the study of genetics improved?

Advanced Animal Genetics

Lesson Plan

Class 3 (continued)

Step 1: Bell Ringer:



- Students should provide a progress report for the **DNA Model Project**.

Step 2: Show the **Section 3: Sex Determination, Animal Selection, EPD: Expected Progeny Difference, Mutations, Improvements, Conclusion** video segments.



- These videos are a total of ten minutes long.
- Be sure students utilize the **Key Concepts** for this segment of the lesson.

Step 3: Administer the **Segment 3 Check for Understanding**.



- The Check for Understanding is a short review of the content presented in the lesson.

Step 4: Students should complete the **Genetics Lab Activity**.



- Students will complete a Punnett square and determine the phenotypes of possible offspring.

Step 5: Exit Ticket:



- Have students write down three concepts they learned from the lesson. If time allows, have them share one as they leave class.

Class 4

Class Overview:

- Action Plan
- Advanced Animal Genetics Final Assessment
- DNA Model Project

Step 1: Bell Ringer:



- Students should review for the assessment.

Step 2: Administer the **Advanced Animal Genetics Final Assessment**.



- The Final Assessment is a comprehensive assessment covering material throughout the entire lesson.

Step 3: Students should complete the **DNA Model Project**.



- Students should present and submit their completed project.

Step 4: Exit Ticket:



- Students should answer one of the **Essential Questions** as they leave class.

Advanced Animal Genetics

Activity

Animal Cell Diagram

Students will complete the diagram to expand and apply their knowledge of the animal cell.

Accommodations:

Allow students to complete this activity in pairs or groups.

Modifications:

Have students color the animal cell, then help the student label the parts.

Extension:

Have students use the activity as a guide to create a 3-D cell diagram using craft supplies or other materials.

Comparisons of Mitosis & Meiosis

Students will compare the processes of mitosis and meiosis to further understand both the differences and importance of the processes.

Accommodations:

Allow students to complete this activity in pairs or groups.

Modifications:

Have the student write the definition of mitosis and meiosis and include which cells are involved.

Extension:

Have students make a presentation board of their findings based on the activity and share it with the class.

Comparisons of DNA & RNA

Students will compare and contrast DNA and RNA using a Venn diagram to further comprehend the two essential structures.

Accommodations:

Allow students to refer to their **Key Concepts** and re-watch the segment to complete the activity.

Modifications:

Have students write one key point in each area of the Venn diagram.

Extension:

Split the classroom into three equal groups. Assign each group a different subject: DNA, RNA or both. Each group must complete research on the given topic, then collaborate as a class to create one large Venn diagram.

Advanced Animal Genetics

Activities

Genetics Lab

Students will complete a Punnett square to determine possible phenotypes and genotypes of offspring while further applying the concept of dominant and recessive genes.

Accommodations:

Have students check their answers with their peers. If there are differences in answers, allow for discussion.

Modifications:

Students only complete the second, more simple Punnett square.

Extension:

Show students an image of a sire and dam. From that image, have students create a Punnett square to what the offspring will look like.

Projects

DNA Model

Students will create a model of DNA to express and further their understanding of the structure of DNA and the processes of translation, transcription and mutation.

Supplies List:

- Different colored pipe cleaners
- Super Bubble[®] gum

Accommodations:

Allow students to complete in pairs or groups.

Modifications:

Have students draw a DNA strand and label the parts.

Extension:

Have students create a science or Agriscience Fair project for a science class or FFA event.

Heritable Traits

Students will apply their knowledge of advanced animal genetics as they create their own offspring. This requires students to effectively apply an understanding of dominant and recessive genes.

Accommodations:

Limit the number of gene combinations used.

Modifications:

Have students identify and label different phenotypes of an animal based on an image.

Extension:

After completion of the activity, have students create their own animal from their own choices. Have students illustrate the animal and present to the class.

Advanced Animal Genetics

Career & Technical Student Organizations

FFA

- Livestock Evaluation
- Agriscience Fair

Career Connections

Career Connections

Using the **Career Connections Activity** allows students to explore careers associated with this lesson by viewing career interviews with various industry professionals. The career interviews are located on the Select Playlist drop down menu on the lesson page. If Student Licenses are being utilized, students can select the interviews to watch based on your directions. If only a Teacher License is being utilized, show students all of the career interviews and instruct them to only complete the interview form for the required number of interviews. See the **Career Connections Activity** for more details.

- Kim Green, Genetics Lab Technician, Global Genetics & Biologicals
- Gary Rohrer, Ph.D., Research Geneticist, U.S. Meat Animal Research Center
- Michael Heaton, Ph.D., Molecular Genomics Livestock Researcher, U.S. Meat Animal Research Center

