

Lesson B4–6

Understanding Organismic Biotechnology

Unit B. Animal Science and the Industry

Problem Area 4. Understanding Animal Reproduction and Biotechnology

Lesson 6. Understanding Organismic Biotechnology

New Mexico Content Standard:

Pathway Strand: Animal Systems

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

Benchmark: IV-C. Evaluate an animal to determine its breeding soundness.

Performance Standard: 1. Describe the procedure for determining an animal's breeding readiness. 2. Identify and prevent problems associated with reproduction. 3. Select animals based on breeding soundness.

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

1. Identify the major areas of biotechnology in animal science.
2. Discuss applications of organismic biotechnology.

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

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

Lee, J.S., Hutter, J., Rudd, R., Westrom, L., Bull, A.M., Embry Mohr, C. & Pollock, J. *Introduction to Livestock and Companion Animals*, 2nd Edition. Danville, IL: Interstate Publishers, Inc. 2000. (Chapter 6)

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

Gillespie, J.R. *Modern Livestock & Poultry Production*, 6th Edition. Albany, NY: Delmar. 2002. (Unit 9)

Lee, S.J., Mecey-Smith, C., Morgan, E.M., Chelewski, R.E., Hunewill, R. & Lee, J.S. *Biotechnology*. Danville, IL: Interstate Publishers, Inc. 2001. (Chapter 10)

List of Equipment, Tools, Supplies, and Facilities

Writing surface

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

Animal biotechnology
Biotechnology
Embryo transfer
Molecular biotechnology
Organismic biotechnology
Superovulation

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Ask the students, "Is biotechnology safe?" Lead discussion to the point that there are many practices done by animal producers every day that are a form of biotechnology.

Summary of Content and Teaching Strategies

Objective 1: Identify the major areas of biotechnology in animal science.

Anticipated Problem: What are the major areas of biotechnology in animal science?

- I. **Biotechnology** is the management of biological systems for the benefit of people and their environment. It is also viewed as the application of science in food and fiber production. Biotechnology has been used for hundreds of years. Using yeast to make bread and bacteria to make cheese are everyday examples of biotechnology. **Animal biotechnology** is the application of biotechnology methods to improve animals. There are two major areas of biotechnology in animal science. They are:
 - A. Molecular biotechnology—**Molecular biotechnology** is changing the structure and parts of cells to change the organism. It begins with the atom. Molecular biotechnology often changes the physical appearance of an organism. In some cases, undesirable traits may develop along with those that are desired.
 - B. Organismic biotechnology—**Organismic biotechnology** deals with intact or complete organisms. The genetic makeup of the organism is not artificially changed. This is the most widely used type of biotechnology.

*There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the major areas of biotechnology in animal science. Chapter 6 in *Introduction to Livestock and Companion Animals* is recommended.*

Objective 2: Discuss applications of organismic biotechnology.

Anticipated Problem: What are some applications of organismic biotechnology?

- II. Most animal management practices done in livestock production are organismic biotechnology. Several examples of this area of biotechnology are:
 - A. Greater fertility—Increasing the reproductive capacity of top animals is important to producers. Two methods to increase the reproductive capacity of animals are:
 1. Superovulation—**Superovulation** is getting a female to release more than the usual number of eggs during a single estrous cycle. Hormones are injected to assure more eggs.
 2. Embryo transfer—**Embryo transfer** is taking an embryo from its mother and implanting it in another female. The embryo completes development in the recipient.
 - B. Increased production—Three methods used to increase production are:
 1. Milk hormones—Injections of milk hormones cause the cow's mammary system to become more productive. The most common milk hormone is bovine somatotropin (bST). Since bST is a naturally occurring hormone, it has been widely accepted in the dairy industry.

2. Meat hormones—Injections of meat hormones causes the animal to produce more muscle cells resulting in larger and leaner cuts of valuable meat.
 3. Growth implants—Growth implants are small pellets placed under the skin. They promote growth by making the animal more feed efficient.
- C. Enhancing animal nutrition—The greatest results of biotechnology have seen in animal nutrition. Some of the enhancements are:
1. Digestibility testing—Tests are made by getting samples from the digestive systems of animals after they have eaten. This information is used to improve feed use and animal growth.
 2. Controlled feeding—Computer chips can be put in a monitor around the animal's neck, ear tag or under the skin. A computerized feeding station will read the chip and regulate the amount of feed the animal receives. Daily feed intake by the animal is used to aid in the detection of health problems.

There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the applications of organismic biotechnology. Chapter 6 in Introduction to Livestock and Companion Animals is recommended.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at end of chapters in the textbook may also be used in the review/summary.

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

Answers to Sample Test:

Part One: Matching

1 = d, 2 = e, 3 = f, 4 = a, 5 = c, 6 = b

Part Two: Completion

1. bovine somatotropin (bST)
2. health
3. muscle
4. Organismic biotechnology

Part Three: Short Answer

1. Organismic and Molecular
2. Milk Hormones, Meat Hormones, and Growth Implants

Test

Lesson B4–6: Understanding Molecular Biotechnology

Part One: Matching

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

- | | |
|-----------------------------|----------------------------|
| a. Animal biotechnology | d. Biotechnology |
| b. Embryo transfer | e. Molecular biotechnology |
| c. Organismic biotechnology | f. Superovulation |

- _____ 1. The application of science in food and fiber production.
- _____ 2. Changing the structure and parts of cells to change the organism.
- _____ 3. Getting a female to release more than the usual number of eggs during a single estrous cycle.
- _____ 4. The application of biotechnology methods to improve animals.
- _____ 5. Deals with intact or complete organisms.
- _____ 6. Taking an embryo from its mother and implanting it in another female

Part Two: Completion

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

1. The most common milk hormone is _____.
2. Daily feed intake by the animal is used to aid in the detection of _____ problems.
3. Injections of meat hormones causes the animal to produce more _____ cells
4. _____ is the most widely used type of biotechnology.

Part Three: Short Answer

Instructions. Provide information to answer the following questions.

1. What are the two types of biotechnology?
2. List the three organismic methods used to increase production.