



Classifying Animal Medications

Unit: Animal Science and the Industry

Problem Area: Animal Health and Administering Veterinary Care

Lesson: Classifying Animal Medications

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

- 1 Distinguish between the two classifications of drugs (biologics and pharmaceuticals).**
- 2 Examine the use of vaccines in disease control and distinguish between modified live and killed vaccines.**
- 3 Examine the types (antibiotics, steroids, sulfa compounds, hormones) and forms (liquids, powder, boluses, drenches, and feed additives) of pharmaceuticals.**
- 4 Describe appropriate storage methods for medications and recognize how improper storage conditions may affect drugs.**

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

Corresponding E-unit(s). Danville, IL: CAERT, Inc. www.mycaert.com

■ **List of Equipment, Tools, Supplies, and Facilities**

- ✓ Copies of sample test
- ✓ Visual from accompanying master
- ✓ Copies of student lab sheet

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

- ▶ adjuvants
- ▶ antibiotics
- ▶ antigen
- ▶ biologics
- ▶ bolus
- ▶ drench
- ▶ feed additive
- ▶ hormone
- ▶ killed vaccine
- ▶ liquids
- ▶ modified live vaccine
- ▶ pharmaceuticals
- ▶ powder
- ▶ steroids
- ▶ sulfa compound
- ▶ vaccine

■ **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.

VM–A examines the influenza pandemic of 1918 and the potential threat of Avian Flu. Have students read, analyze, and discuss the abstract with their peers. Facilitate a discussion on the significance of disease prevention as it pertains to humans, animals, and plants.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Distinguish between the two classifications of drugs (biologics and pharmaceuticals).

Anticipated Problem: What are the two major classifications of drugs, and what are the major distinctions between them?

- I. There are two major classifications of drugs, biologics and pharmaceuticals.
 - A. Biologics
 1. **Biologics** are medicinal products derived from living sources, such as humans, animals, or microorganisms, as opposed to chemical sources.

2. Biologics include a wide array of medical products, such as vaccines, blood and blood components, allergenics, somatic cells, gene therapy, tissues, and recombinant therapeutic proteins.
- B. Pharmaceuticals
1. **Pharmaceuticals** are synthetically or artificially created drugs or medicines used to treat disease and medical disorders.
 2. There are many classes of drugs used in veterinary medicine. Eleven broad areas of medications include: central nervous system drugs, cardiovascular drugs, respiratory drugs, kidney and urinary tract drugs, gastrointestinal agents, hormones, anti-infective drugs, blood modifying agents, fluid and electrolyte modifiers, anticancer/immunosuppressives, and some miscellaneous agents.
 - a. Central nervous system drugs are used for a wide variety of reasons, such as treating seizure disorders, helping a dog with anxiety, and providing pain relief for chronic pain conditions. This group contains classes of drugs that include anti-inflammatories, analgesics, muscle relaxants, behavior drugs, euthanasia drugs, and anesthetics. An example of a combined anti-inflammatory and analgesic drug is aspirin. Analgesic means the drug helps to reduce pain.
 - b. Cardiovascular drugs help the heart function and are used to treat animals with heart disease. Some class examples include anti-arrhythmic drugs, ACE inhibitors, shock agents, beta blockers, and calcium channel blockers. An example of a drug used to treat shock is epinephrine and can be used to help an animal that has a severe anaphylactic reaction to a vaccine or insect sting.
 - c. Respiratory drugs are used to help animals with breathing problems, such as asthma. This group includes classes such as antihistamines (for allergies), antitussives (anti-cough), and bronchodilators (for asthma). Benadryl, or diphenhydramine, is an antihistamine used to treat allergic skin conditions and relieve itching.
 - d. Kidney and urinary tract drugs help with urinary tract infections, kidney failure, and bladder/kidney stones. Class examples of this group include diuretics, agents for urinary incontinence, and urinary alkalizers and acidifiers. A diuretic increases the output of urine in an animal without it having to drink more water (which is similar to the effect caffeine has on humans). An example of a diuretic is furosemide, or Lasix.
 - e. Gastrointestinal (GI) agents help with disorders of the stomach and intestines. Class examples in this group include antiulcer medications, appetite stimulants, laxatives, and antidiarrheals. Pepto Bismol, or bismuth subsalicylate, is an antidiarrheal drug that helps stop diarrhea. Pepcid AC, or famotidine, is a familiar antiulcer medication used to help prevent excessive acid production and help treat acid reflux.
 - f. Hormones are drugs that help to regulate reproductive systems and treat conditions such as diabetes. Class examples in this group include estrogens, steroids, antidiabetic agents, thyroid drugs, and prostaglandins. An example of an antidiabetic drug is insulin, which is lacking in animals

- with diabetes. Insulin helps to digest glucose, and, without insulin, glucose levels continue to rise after eating a meal and can cause major problems.
- g. Antiinfective agents are drugs that help control parasites and fight bacterial infections, virus infections, and fungal infections. Class examples in this group include penicillins, tetracyclines, cephalosporins, antifungals, and antivirals. Itraconazole is an anti-fungal agent used to treat ringworm in pets.
 - h. Blood-modifying agents help treat diseases that can cause blood clots or excessive bleeding. Class examples include heparin antagonists, vitamin K, and anticoagulants. Heparin is a common drug used to help keep platelets from sticking together and prevent blood clots from forming.
 - i. Fluid and electrolyte modifiers help treat imbalances relating to dehydration and fluid loss. Hetastarch is an example of a fluid used to treat animals in shock that have excessive blood loss due to trauma, such as being hit by a car.
 - j. Anticancer and immunosuppressive drugs help to treat various types of cancer and diseases that result from the immune system turning against the animal's own body. Piroxicam is an example of an anti-cancer drug used to treat certain types of colon cancer.
 - k. Some miscellaneous agents include antidotes to treat poisonings, joint agents to treat arthritis, and vitamins and minerals. Ethanol, also known as alcohol, is used to treat animals that have been poisoned by consuming anti-freeze.

Many techniques can be used to help students master this objective. Question students about the content as presented and use the corresponding E-unit(s) to reinforce the content.

Objective 2: Examine the use of vaccines in disease control and distinguish between modified live and killed vaccines.

Anticipated Problem: How are vaccines used in disease control, and what are the differences between modified live and killed vaccines?

- II. Vaccines are used extensively to prevent diseases in both animals and humans.
 - A. A **vaccine** is a biologic that uses a killed or debilitated organism that is capable of inducing protection against the specific disease caused by that organism.
 - B. Vaccines help prevent disease by triggering the body's immune system to make antibodies that will protect the animal against the disease-causing organism if exposed to it in the future. The immune system will then be prepared to eliminate any intrusion of a disease-causing organism when it enters the body.
 - C. An **antigen** is any agent or substance that stimulates an immune response to foreign microorganisms, including bacteria, viruses, and the toxins they produce.

D. Two major types of vaccines used today are:

1. Killed Vaccines

- a. A **killed vaccine** is a vaccine that uses bacteria or viruses that are killed in a laboratory and are then administered to elicit an immune response.
- b. Killed vaccines must have the correct amount of antigen to elicit the immune system's response. Generally, killed vaccines need more antigen than a modified live vaccine, making them more expensive.
- c. **Adjuvants** are substances mixed with the antigen that help to "irritate" or stimulate the body's immune response to the antigen. Adjuvants are also responsible for causing the majority of vaccine reactions in humans and animals.

2. Modified Live Vaccine

- a. A **modified live vaccine** is a vaccine that uses bacteria or viruses that have been attenuated (weakened) in a laboratory and are then administered to an animal to elicit an immune response.
- b. Modified live vaccines reproduce within the animal, and they require a much smaller amount of antigen, compared to that of killed vaccines. A benefit to modified live vaccines is that they offer quicker protection against disease, and their effects tend to last longer because they mimic the "real disease" but in a safer way than the animal contracting the actual disease.
- c. As the injected virus or bacteria in a modified live vaccine is still living, there are added risks in its use in disease prevention.
 - (1) Modified live vaccines require the active infection of host cells in order to work properly. There is a consequential, although small, risk that a modified live vaccine could revert back to an infectious state and actually cause the disease it is trying to prevent.
 - (2) Modified live vaccines used in pregnant animals could potentially result in abortions. The use of modified live vaccines in pregnant animals should only be conducted with strict adherence to label directions and with guidance from a veterinarian.
- d. Modified live vaccines stimulate the body's cellular immune system more completely in comparison to that of a killed vaccine, which requires an added adjuvant to get comparable results.

Many techniques can be used to help students master this objective. Question students about the content as presented and use the corresponding E-unit(s) to reinforce the content.

Objective 3: Examine the types (antibiotics, steroids, sulfa compounds, hormones) and forms (liquids, powder, boluses, drenches, and feed additives) of pharmaceuticals.

Anticipated Problem: How is each type and form of pharmaceutical used in disease prevention?

III. Various types and forms of medications are used for the treatment and prevention of diseases.

A. Types of pharmaceuticals

1. **Antibiotics** are drugs that kill or prevent the growth of bacteria or protozoa. Most anti-bacterial antibiotics do not have an affect on viruses, fungi, or other microbes.
2. **Steroids** are drugs composed of organic hormones used in the treatment of disease. Common steroids use hormones, such as estrogen and testosterone, as well as cortisone, Vitamin D, and cholesterol.
3. **Sulfa compounds** are synthetic antibacterial compounds capable of inhibiting the growth of bacteria and are used to prevent and treat animal and human diseases.
4. A **hormone** is a chemical or protein that acts as a messenger or stimulatory signal, relaying instructions to stop or start certain physiological processes.

B. Forms of pharmaceuticals

1. **Liquids** are a form of medicine that, depending on their classification, may be given to an animal orally or via injection. Liquid medications are usually stable at room temperature and retain their effectiveness.
2. **Powder** used in medication is a solid that has been pulverized into particles and is used for treatment via inhalation or injection. Often medications found in powder form are unable to be stored in liquid form without becoming ineffective.
3. A **bolus** is a medication, drug, or other compound that is given to raise blood concentration to an effective level. In veterinary medicine, a bolus is a large time-release tablet that stays in the rumen of cattle, goats, and sheep.
4. A **drench** is a draft of medicine given to an animal by pouring it into its mouth and commonly includes the dewormers used in livestock and horses.
5. A **feed additive** is a substance added to animal feed to improve its nutritional value, promote growth, or control disease.

Many techniques can be used to help students master this objective. Question students about the content as presented and use the corresponding E-unit(s) to reinforce the content.

Objective 4: Describe appropriate storage methods for medications and recognize how improper storage conditions may affect drugs.

Anticipated Problem: How and for what reasons must medications be stored properly?

- IV. Proper storage facilities improve medication effectiveness and reduce treatment errors.
- A. Moisture is a major problem for drugs that are in the form of tablets and powders. These products should remain in airtight containers to avoid moisture build up and kept in a dry place.
 - B. Product decomposition may result from exposure to light. Manufacturers package light-sensitive products in light-resistant containers. These should be kept in a lightproof storage unit.
 - C. Temperature Sensitive
 - 1. Keep liquid medicines from freezing.
 - 2. Vaccines containing modified live organisms must be kept refrigerated once mixed and must be used within a short amount of time or their ingredients will become ineffective.
 - 3. Most antibiotics are heat sensitive. Store these products in a refrigerator at a temperature between 2° and 8°C to maintain potency. Many other products require storage in a cool (below 15°C) but non-refrigerated location. Check product labels for information on acceptable storage temperature.
 - D. Due to exposure to O₂ and CO₂ in the air in combination with moisture, many drugs can be damaged if exposed to these elements. If a drug is exposed to air and moisture, it is also prone to bacteria, mold, and fungus growth. If these agents are allowed to grow in a drug, using them on an animal could cause a disease, rather than treating a disease.
 - E. Biological drugs and antibiotics lose their potency with time. Vaccines, if used after their expiration date, will not be effective.
 - F. The ideal location for a storage unit is a clean, dry, frost-free area, such as a farm office or utility room. Animal health products should be protected from changes in temperature, sunlight, dust, moisture, animals, and insects. A clean, organized refrigerator makes an ideal drug storage unit.
 - G. When in doubt about the proper use of medications, you should check the label on the medication and consult a local veterinarian.

Many techniques can be used to help students master this objective. Question students about the content as presented and use the corresponding E-unit(s) to reinforce the content.

- **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.

- **Application.** Use the included visual master and lab sheet to apply the information presented in this lesson.
- **Evaluation.** Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. The sample written test can also be used.

■ **Answers to Sample Test:**

Part One: Matching

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

Part Two: Multiple Choice

1. b
2. b
3. d
4. a
5. d

Part Three: Short Answer

1. Answers will vary. The following points should be included in student answers: A killed vaccine is a vaccine that uses bacteria or viruses that are killed in a laboratory and are then administered in a vaccine form to elicit an immune response. A modified live vaccine is a vaccine that uses bacteria or viruses that have been attenuated (weakened) in a laboratory and are then administered to an animal to elicit an immune response. Modified live vaccines stimulate the body's cellular immune system more completely in comparison to that of a killed virus, which requires an adjuvant to get comparable results.

2. Answers will vary. The following points should be included in student answers: A hormone is a chemical or protein that acts as a messenger or stimulatory signal. It relays instructions to stop or start certain physiological processes.
3. Answers will vary. The following points should be included in student answers: Pharmaceuticals are synthetically created drugs or medicines used to treat disease and disorders, whereas biologics are products derived from living sources, such as humans, animals, or microorganisms. Biologics include vaccines, blood, and blood components. Pharmaceuticals generally include antipyretics (fever reducers), analgesics (painkillers), anti-malarial, antibiotics (inhibitors of germ growth internally), and antiseptics (inhibitors of germ growth externally).
4. Answers will vary. The following points should be included in student answers: The ideal location for the storage of vaccines and antibiotics is a clean, dry, frost-free area, such as a farm office or utility room. Animal health products should be protected from changes in temperature, sunlight, dust, moisture, animals, and insects. A clean, organized refrigerator makes an ideal drug storage unit.
5. Answers will vary. The following points should be included in student answers: Vaccines help prevent disease by triggering the body's immune system to make antibodies that will protect itself against the disease-causing organism. The immune system will then be prepared to eliminate any intrusion of that specific organism should it later enter the body.

Classifying Animal Medications

► Part One: Matching

Instructions: Match the term with the correct definition.

- | | |
|--------------------------|-------------------|
| a. adjuvant | f. vaccine |
| b. bolus | g. killed vaccine |
| c. antibiotic | h. antigen |
| d. modified live vaccine | i. sulfa compound |
| e. biologic | j. pharmaceutical |

- _____ 1. A vaccine that uses bacteria or a virus that has been attenuated (weakened) in a laboratory and is then administered to elicit an immune response
- _____ 2. A vaccine that uses bacteria or viruses that are killed in a laboratory and is then administered to elicit an immune response
- _____ 3. Any agent or substance that stimulates an immune response, such as foreign microorganisms, including bacteria or viruses, or the substances they produce
- _____ 4. Foreign materials mixed with the vaccine antigen that enhances the body's response to the antigen
- _____ 5. Synthetically created drugs or medicines used to treat disease and disorders
- _____ 6. A biologic that uses a killed or debilitated organism that is capable of inducing protection against the specific disease caused by that organism
- _____ 7. A medication that is given in a sufficiently large dose to raise blood concentration to an effective level
- _____ 8. A drug that kills or prevents the growth of bacteria and has no affect on viruses or fungal infections
- _____ 9. Synthetic antibacterial compounds capable of inhibiting the growth of bacteria and used to prevent and treat animal and human diseases
- _____ 10. Products derived from living sources, such as humans, animals, or microorganisms, as opposed to chemical sources, often used for medicinal purposes

► **Part Two: Multiple Choice**

Instructions: Write the letter of the correct answer.

- _____ 1. Vaccines, blood, and blood components, allergenics, and tissues are all types of _____ used for medical purposes.
- a. pharmaceuticals
 - b. biologics
 - c. adjuvants
 - d. modified live vaccines
- _____ 2. _____ most commonly use adjuvants to enhance the body's response to an antigen.
- a. Toxic vaccines
 - b. Killed vaccines
 - c. Modified live vaccines
 - d. Particle vaccines
- _____ 3. Most _____ are temperature sensitive and should be stored in a cool location, such as a refrigerator.
- a. antigens
 - b. steroids
 - c. hormones
 - d. antibiotics
- _____ 4. After their expiration date, vaccines _____.
- a. will not be as effective and may be contaminated
 - b. become too potent and dangerous to use
 - c. in the virus will multiply and revert back into a viral state
 - d. become too weak and dangerous to use
- _____ 5. A drench is a medicine given to an animal by _____.
- a. mixing it with its food
 - b. mixing it with its water
 - c. injecting it into its side
 - d. pouring it into its mouth

► **Part Three: Short Answer**

Instructions: Complete the following.

1. Compare and contrast a modified live vaccine and a killed vaccine.
2. Describe the role of a hormone.
3. Compare and contrast a pharmaceutical and a biologic.
4. Describe an ideal location to store vaccines and antibiotics.
5. Describe how a vaccine helps prevent disease in the body.

THE INFLUENZA PANDEMIC OF 1918 AND THE POTENTIAL THREAT OF AVIAN FLU

The Spanish Flu of 1918 was fast, painful, and lethal. It killed an estimated 50 to 100 million people worldwide—more than all the casualties of World War I and possibly more than the Black Plague that took place during the Middle Ages. This uncontrollable pandemic selectively targeted young, healthy adults instead of children or the elderly. Without a youthful workforce to maintain transportation and public amenities, entire regions were weakened economically by this influenza virus. Where did the virus first appear? The most recent theory is that the virus originated at Fort Riley, Kansas, after mutating from a strain of influenza commonly found in poultry. It changed quickly into a virus with the ability to spread rapidly from one human to another. Because of substantial troop movement across the globe during World War I, the virus spread even more rapidly. The Spanish Flu brought a substantial portion of the world to a halt as it tried to deal with the pandemic.

Of course the world is different now than it was in 1918. There are now a number of medical disease-stopping tools at our disposal. There is, however, a question of whether these new medical advances would be able to prevent us from another pandemic similar to that of the Spanish Flu of 1918. Unfortunately, the threat is more of a reality than most of us would like to believe. There is currently a strain of influenza that is being closely monitored by scientists, health organizations, and governments across the world. This strain is Influenza A virus subtype H5N1, also known as “Avian Influenza,” or “Bird Flu.” This strain of Bird Flu was discovered in Asia and originally started as an easily transmissible

influenza virus that infected mostly wild birds. The virus eventually spread to domesticated fowl, such as chickens and turkeys, and has since mutated into a virus that has the ability to infect other animal species, including humans. Why is the Bird Flu being watched so closely? This particular strain of influenza has a high tendency to mutate and a few features that make it unique among influenza viruses. To date, no evidence has been discovered of human-to-human or airborne transmission of the virus, but since the virus has a tendency to transform, there is significant potential for this particular virus to change into a virus of major concern if not dealt with appropriately. Recent genetic analysis of the H5N1 strain of the virus indicated that any kind of mutated version created from this particular strain could be far more lethal than the Spanish Flu pandemic. In addition, because migratory birds are among the carriers of the H5N1 virus, it is spreading rapidly across the globe. What makes this virus particularly unique is that it has the ability to spread to other animals rather than its original target of poultry. Also, because many wild birds can be carriers without showing any immediate symptoms, the virus is very difficult to track by scientists.

It should be noted that the virus cannot be spread through cooked poultry. In addition, the United States Department of Agriculture (USDA) will destroy any birds that are found to be infected and compensate producers for their flock and equipment. By incorporating these practices and others to control the Bird Flu, it may be possible to slow the spread of the virus in America. There are further steps being taken to help prevent the spread of the virus if it does happen to develop the ability to be spread by humans. A drug, called Tamiflu®, has been developed that inhibits the influenza virus from spreading inside the user's body. However, as the virus continues to alter, it is impossible to create a matching vaccine that will prevent the virus in humans since it has not yet mutated into a form that can be spread by humans. On a positive note, an experiment conducted in London indicates that an enzyme mixture created by the Icelandic company, Zymetech, killed the H5N1 strain with a 99 percent success rate in less than five minutes, without damaging healthy cells.

Much of the world is working to contain the Bird Flu threat, but this strain of influenza and other viruses are a very real danger to the human population even today. It would be wise for us to keep a close watch on emerging diseases in order to prevent a pandemic similar to the one that occurred in 1918.

SCIENCE CONNECTIONS:

Some Questions for Investigation

1. How and why did the Spanish Flu of 1918 likely spread across the world so rapidly?
2. Why is it important to get vaccinated for various diseases?
3. What steps have governments taken to attempt to control the Bird Flu?

Medication Investigation

Purpose

The purpose of this activity is to explore currently marketed animal medications for various forms or types of medication.

Objective

List different animal medicines and describe their handling and storage recommendations.

Materials

- ◆ Internet access or medical product guide

Procedure

1. With your teacher’s permission, you may be asked to use online sources to find medical information. If there is no Internet access available, product guides will be used instead.
2. Complete the following chart for each type of medication by listing two different examples, what type of animal it is used with, and a brief description of the handling and storage procedures for that medication. Be sure to include your source by recording the name of the website or product guide used to find your information. Some examples may be able to be used twice.

Type/Form	Example	Animal	Handling/Storage Recommendations
Antibiotic			
Steroid			

Vaccine			
Sulfa Compound			
Bolus			
Drench			
Feed Additive			
Powdered Medication			
Liquid Medication			

Suggested Websites for Investigation

Pfizer Animal Health

<http://www.pfizerah.com/>

AlliVet Pet Pharmacy

<http://www.allivet.com/>

Fort Dodge Animal Health Livestock Solutions

<http://www.fortdodgelivestock.com/>