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4-H, Youth and Family (includes home livestock)

Title

Pre-Harvest Food Safety in 4-H Animal Science Complete (Parts 1 through 4)

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Pre-Harvest Food Safety in 4-H Animal Science

Part 1: Assessing Critical Control Points Associated with Disease Transmission

Overview and Background Information

The goal of pre-harvest food safety efforts is to protect the human food supply from pathogens, parasites, and other harmful agents. This requires vigilance and the application of specific knowledge and skills throughout the entire production process.

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Animals are susceptible to a variety of diseases that can pass from one animal to another through direct and indirect transmission. **Direct transmission** occurs when a previously uninfected animal contracts a disease after a physical interaction with an infected animal. **Indirect transmission** occurs when an uninfected animal comes into contact with some contaminated surface (e.g., the floor of a transport trailer) or object (e.g., a food or water trough) or a **vector** (e.g., a disease-carrying insect or vermin) that transmits a **pathogen** (a disease-causing agent).

To help prevent disease transmission among food animals, it is important to carry out an assessment of potential hazards based on **Hazard Analysis and Critical Control Points** (HACCP). Critical control points are places or situations that present a high risk of disease transmission (e.g., risks during production and transport). The HACCP assessment identifies potential critical control points that occur during production and implements practices or conditions that will prevent, eliminate, or reduce these risks.

Activity Concepts and Vocabulary

- **Hazard Analysis and Critical Control Points (HACCP):** A systematic approach to identifying, evaluating, and controlling food safety hazards.
- **Critical control point (CCP):** A point, step, or procedure in the process of growing food where humans can introduce a process that can help prevent, eliminate, or reduce a food safety hazard.
- **Direct transmission:** Physical contact between an ill person or animal and a healthy person or animal that leads to the transmission of a disease.
- **Indirect transmission:** The transfer of pathogens to an uninfected person or animal through contact with the contaminated surface of an inanimate object (e.g., a food dish; the floor of a transport trailer).
- **Pathogen:** A disease-causing organism.
- **Pre-Harvest Food Safety:** The protection of human health through the reduction of pathogens associated with livestock or poultry that enter the food supply.
- **Vector:** An organism, such as an insect or vermin, that carries disease-causing microorganisms from one animal to another.

Life Skills

- **Head:** Critical thinking, problem solving, decision making
- **Heart:** Communication, sharing, cooperation
- **Hands:** Contributions to a group effort, teamwork
- **Health:** Disease prevention

Subject Links

Science, language arts

Next-Generation Science Standards (NGSS) Crosscutting Concepts

- **Patterns:** Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- **Cause and Effect:** Mechanism and explanation. Events have causes, sometimes simple, sometimes multi-faceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- **Stability and Change:** For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Purpose of Activity

The purpose of this activity is to have youth learn to identify critical control points in food animal production and understand the importance of those points as related to the spread of disease. Knowledge of critical control points can help youth who raise food-producing animals determine what measures they can take to prevent and control the spread of disease among animals.

Overview of Activity

This activity focuses on various components that are necessary to maintaining the health of food animals from the time of their initial acquisition up to the point of sale or harvest, including reducing the risk of disease transmission through the identification, evaluation, and control of food safety hazards. Through learning activities that simulate livestock management situations, youth will learn to identify critical control points and determine how and when their hypothetical animals may be at risk of contracting a disease.

Time Required

45–75 minutes

Suggested Grouping

Small groups of 3 to 4

Materials Needed

(* = *Materials provided in curriculum*)

- * *Animal Situation Cards*
- * *Disease Descriptions*
- * *Critical Control Point Pictures*
- Construction paper
- Glue
- Flipchart paper
- Pens or pencils; markers

Getting Ready

- Make enough *Animal Situation Cards* so each group gets at least one card.
- Make enough *Disease Descriptions* so each group gets a complete set.
- Make enough copies of the *Critical Control Point Pictures* so each group gets a complete set. Cut out the *Critical Control Point Pictures*.
- Make sure each group gets a piece of construction paper, some glue, some flipchart paper, and pens, pencils, or markers.

Opening Questions

1. Why do you think it is important to keep animals healthy, especially when they are being raised to provide food for human consumption? Please share your ideas verbally or write them down on the flipchart paper.
2. What do you think are some potential ways for a food animal to contract an illness? Please share your ideas verbally or write them down on the flipchart paper.
3. How do you think you can prevent a food animal from getting sick? Please share your ideas verbally or write them down on the flipchart paper.

Procedure (Experiencing)

1. Give each group an *Animal Situation Card*. Each card contains information on one animal (beef cow, poultry, swine, sheep, or dairy cow) and includes a list of symptoms the animal is exhibiting.

2. Pass out the *Disease Descriptions* and ask each group to do research to determine what disease their animal may have contracted.
3. Have a volunteer pretend to be a veterinarian. Once a group has determined what disease their animal might have, have them go to the veterinarian to see if their determination is accurate. If it is, the veterinarian will give them a set of *Critical Control Point Pictures*. If their diagnosis is wrong, the veterinarian will ask the group to try again until they come up with an accurate diagnosis. Once they have diagnosed their animal correctly, the veterinarian will give the group a set of *Critical Control Point Pictures*.
 - » **Volunteer Tip:** Here are the correct diagnoses for each *Animal Situation Card*:
 - Chicken: Salmonella
 - Dairy cow: Bovine tuberculosis
 - Lamb: *E. coli* scours
 - Swine: Campylobacter
 - Beef: Foot and mouth disease
4. When the groups get the *Critical Control Point Pictures*, say “As your veterinarian, I wanted to let you know that there are steps you can take to prevent or minimize the spread of the disease your animal has acquired. I would like you to evaluate the location where the animal is housed and your daily animal care practices.”
5. Looking at their *Critical Control Point Pictures*, ask the groups to choose which pictures show situations that they think either contributed to their animal’s illness or have the potential to affect the health of their animal. Have them glue the pictures they chose onto the construction paper.

Sharing, Processing, and Generalizing

Follow the lines of thinking developed by the youth as they share and compare their ideas and observations; if necessary, use more targeted questions as prompts to get to particular points. Specific questions might include

1. How do you think your animal contracted the disease?
2. Which pictures do you think apply to your animal and its diagnosed disease? Why?
3. What could you have done to prevent your animal from catching this disease?
4. What can you do in the future to prevent your animal from getting sick?

Concept and Term Introduction/Discovery

At this point, volunteers need to ensure that the concepts and terms **critical control point, direct transmission, HACCP, indirect transmission, pathogen, pre-harvest food safety, and vector** have been introduced. (**Note:** The goal is to have the youth develop these concepts through their own exploration and define the terms using their own words.)

Concept Application

For those youth who raise food-producing animals:

- Using the *Critical Control Point Pictures* as a reference, do an assessment of your food-producing animal’s living area and make a list of all the potential critical control points your animal may encounter.
- Then think of ways to try to reduce those risks. Make a list of your ideas.

For those youth who do not raise food-producing animals:

- Ask a friend, neighbor, or relative if you can observe their food-producing animal's primary living area. Using the *Critical Control Point Pictures* as a reference, do an assessment of the food-producing animal's living area and make a list of all the potential critical control points the animal may encounter.
- Then think of ways to try to reduce those risks. Make a list of your ideas.

REFERENCES

- APHIS Veterinary Services. Foot-and-mouth disease. www.aphis.usda.gov/publications/animal_health/content/printable_version/fs_foot_mouth_disease07.pdf
- Beals, T. F. 2008. The risk of bovine TB from raw milk consumption with a focus on Michigan. www.westonaprice.org/farm-a-ranch/risk-of-bovine-tb-from-raw-milk-consumption.html
- Center for Disease Control and Prevention. Salmonellosis. www.cdc.gov/nczved/dfbmd/disease_listing/salmonellosis_gi.html#6
- The Center for Food Security & Public Health, Iowa State University. Bovine tuberculosis. www.cfsph.iastate.edu/Factsheets/pdfs/bovine_tuberculosis.pdf
- The Center for Food Security & Public Health, Iowa State University. *Escherichia coli* 0157:H7 infections. www.cfsph.iastate.edu/Factsheets/pdfs/e_coli.pdf
- The Center for Food Security & Public Health. Iowa State University. Foot-and-mouth disease. www.cfsph.iastate.edu/Factsheets/pdfs/foot_and_mouth_disease.pdf
- Childers, A. B., and B. Walsh. 1996. Pre-harvest food safety. *Annals of the New York Academy of Sciences*. 791(1):314–317.
- Daneke Club Lambs and Livestock. *E. coli* scours, watery mouth. www.danekeclublambs.com/EcoliScoursWateryMouth.html
- Department of Health, New York State. Campylobacteriosis. www.health.state.ny.us/diseases/communicable/campylobacteriosis/fact_sheet.htm
- Kirk, J. 2003. Tuberculosis—Human and cattle. *School of Veterinary Medicine, University of California Davis, Tulare, CA, 93274*, 13.
- ThePigSite.com. Campylobacter. www.thepigsite.com/diseaseinfo/23/campylobacter
- ThePigSite. Salmonellosis, *S. enteritidis*, and *S. typhimurium* infections. www.thepoultrysite.com/diseaseinfo/133/salmonellosis-s-enteritidis-and-s-typhimurium-infections
- Purdue Extension. Foot-and-mouth disease. www.ces.purdue.edu/extmedia/vy/vy-62new.pdf
- Rook, J. S. (n.d.) Sloppy spring weather produces its own unique set of health problems. <http://old.cvm.msu.edu/extension/Rook/ROOKpdf/Msbecoli.PDF>
- Schoenian, S. Sheep diseases A–Z: *E. coli* scours. www.sheep101.info/201/diseasesa-z.html#ecoli
- Science Encyclopedia. Salmonella—Causes and symptoms, treatment, prevention, diagnosis. science.jrank.org/pages/5947/Salmonella.html
- USDA. Salmonella questions and answers. www.fsis.usda.gov/factsheets/salmonella_questions_&answers/index.asp
- Wikipedia. Foot-and-mouth disease. http://en.wikipedia.org/wiki/Foot-and-mouth_disease

ANIMAL SITUATION CARDS**Animal:** Chicken

Scenario: After a few days of watching your chicken, you notice that it is losing weight. You monitor its food and water bowl, and it doesn't look like it eats or drinks much. Your chicken is usually very active, but lately it seems tired and lethargic, closing its eyes for long periods of time. While cleaning its cage, you notice watery feces throughout the cage. You get really worried, so you start researching possible diseases your chicken might have.

Animal: Lamb

Scenario: It is lambing season and your lamb is out and about. One day when cleaning its pen, you notice diarrhea scattered throughout the bedding. Worried, you start looking for your lamb and find it lying next to a tree outside. You try to pick your lamb up but it cries out in pain. You notice that its stomach is very bloated. The lamb also looks really dehydrated, even though its water bowl was empty when you changed it earlier. You get really worried so you start researching possible diseases your lamb might have.

Animal: Dairy Cow

Scenario: One day you notice your dairy cow looking very thin. You observe her for a couple of days and notice that she is not eating. Overall, she is not very active and looks depressed. When you milk your cow during the early morning hours, you notice that she is producing a wet, harsh cough, but the cough seems to get less intense as the day goes on. You get really worried, so you start researching possible diseases your dairy cow might have.


Animal: Swine

Scenario: Your piglet is usually very active, eats well, and is in good overall health. Lately, however, you have noticed some very watery feces around your piglet's bedding. As the days pass, you notice that the piglet's feces change to a creamy diarrhea. You get really worried so you start researching possible diseases your piglet might have.



Animal: Beef

Scenario: You are getting ready for a big show for your steer. In the days leading up to the show, you notice that your steer is acting oddly. You see him laying down for long periods of time and not eating much. When doing a physical exam on your steer, you notice he has a couple of blisters in his mouth surrounded by eroded areas and foamy saliva. You also notice blisters on your animal's hooves. You get really worried so you start researching possible diseases your steer might have.



DISEASE DESCRIPTIONS

Campylobacter

- Campylobacter is a bacterial infection that can infect a variety of animals, including swine, cattle, dogs, and birds.
- In swine, campylobacter is naturally found in the animal's intestinal tract and, rarely, it is found in the bloodstream.
- There are a variety of ways for campylobacter to be passed from one animal to another. It is passed in the feces and can spread and infect when a second animal consumes the bacterium in infected food or water, or when an animal has direct contact with an infected animal.
- Animals that naturally carry campylobacter can easily spread the bacteria through feces left in poorly cleaned pens, through poor hygiene in farrowing pens, on wet, insufficiently cleaned floor surfaces, or from housing that is in continual use without being properly disinfected between animals.
- Piglets with the infection will either develop diarrhea with blood or mucous in it or a creamy diarrhea. They can also become dehydrated and lose body condition.
- Since campylobacter can infect humans, humans have to be very careful about the foods they eat and the animals they touch.
- Humans can catch campylobacter by eating raw, uncooked food products that have come into contact either with animal feces that have the bacteria or with infected humans or animals.
- Humans who touch or interact with animals or animal products that have the potential to carry the campylobacter bacteria should wash their hands to prevent ingestion or passing of the bacteria.
- If humans do catch the disease, they may experience symptoms such as mild or severe diarrhea, often with a fever, and traces of blood in the stool.

***Escherichia coli* (*E. coli*) scours**

- *E. coli* scours come from the bacterium *Escherichia coli* (or *E. coli*), which can infect a variety of animals, including cattle, sheep, goats, pigs, deer, dogs, poultry, and even humans.
- In sheep, *E. coli* can be found in the intestines and the bloodstream.
- There are a number of ways to pass *E. coli* scours from one sheep to another. Usually a sheep becomes infected if it ingests contaminated fleece or bedding.
- Sheep that are infected with the bacteria may develop diarrhea and start to salivate excessively. They may also become painfully bloated and dehydrated.
- Animals that have *E. coli* scours can easily spread the bacteria through their feces.
- There are several ways to minimize the spread of *E. coli*. These include the implementation of proper sanitation protocols, the use of clean bedding, relocation of lambing pens, use of adequate colostrums for lambs, decreased crowding, and improved ventilation to decrease moisture in the animals' area.
- Since *E. coli* can infect humans, humans have to be very careful with the foods they eat and the animals they touch.
- Humans can catch *E. coli* by the fecal-oral route. Humans can be infected by direct contact with diseased animals or by contact with human carriers.
- Humans who touch or interact with animals or animal products that have the potential to carry the *E. coli* bacterium should wash their hands to prevent ingestion or passing of the bacteria.
- If humans do catch the disease, they may experience symptoms such as cramps, pain in the abdomen, and watery feces followed by bloody diarrhea.

Foot and Mouth Disease (FMD)

- Foot and Mouth Disease (FMD) is an extremely contagious disease that has devastating effects on infected animals as well as on the farm economy.
- Currently, the United States is free of FMD.
- This disease is a virus that affects cloven-hoofed animals (e.g., cattle, swine, sheep, goats, and deer).
- The most obvious symptoms include a fever and blisters that form around the mouth and/or feet. As a result of the blisters, infected animals might start salivating excessively, have a hard time walking, develop eroded areas where blisters have ruptured, and lose weight. Some animals with the disease might show no symptoms at all, but still be able to spread the virus to other animals.
- FMD can be transmitted in a number of ways, including close contact animal-to-animal spread, long-distance aerosol spread, and spread via fomites (inanimate objects), typically fodder or motor vehicles.
- The clothes and skin of farmers and other animal handlers, standing water, and uncooked food scraps and feed supplements that contain infected animal products can harbor the virus as well.
- Humans contaminated with the disease can spread it to susceptible animals through the clothing that they wear or the things that they touch.
- Humans can be infected with foot-and-mouth disease through contact with an infected animal, but this is extremely rare. For the few humans who have been infected, symptoms have included fever, vomiting, lesions in the mouth, and blisters on the skin.
- The virus can survive in the environment for up to a month.
- Vaccination is possible, but it is not always effective because the virus mutates quickly.

Salmonella

- *Salmonella* is a bacterial genus that can infect a variety of animals, including poultry, vermin (mice and other rodents), reptiles, and even humans.
- *Salmonella* bacteria are naturally present in the intestines and reproductive tract of poultry.
- Poultry that are infected with *Salmonella* may exhibit diarrhea, loss of appetite and thirst, and a lack of energy. Poultry will generally look depressed, with their eyes closed and their feathers fluffed.
- *Salmonella* can be passed from one animal to another in a variety of ways. Wildlife and pest animals such as flies, rodents, and birds can pass the bacteria through their fecal matter.
- *Salmonella* can collect and flourish in the moisture in animal litter and cages, and can then spread easily to animals that traffic through it.
- Animals that have naturally present *Salmonella* can easily spread the bacteria through their secretions, feces, and feather dust. Wind and air currents can then pick up the bacteria and circulate them throughout the living area.
- Since *Salmonella* can infect humans, humans have to be very careful with the foods they eat and the animals they touch.
- Humans can become infected with *Salmonella* when they eat food products contaminated with animal feces that carry the bacteria or, through cross-contamination, when contaminated food comes into contact with uncontaminated food. Some possible sources are meat (beef or poultry) that is eaten raw, contaminated chicken eggs, and contaminated milk.
- Raw or undercooked foods, dairy products, and even vegetables can also carry *Salmonella*, which is only killed by cooking or pasteurization.
- People who touch or interact with animals and/or animal products that have the potential to carry *Salmonella* bacteria should wash their hands well to prevent ingestion or passing of the bacteria.
- If humans do catch the disease, they may experience symptoms such as cramps in the stomach, fever, watery feces, headache, and nausea. Most of the time, people recover from the infection without help from a doctor.

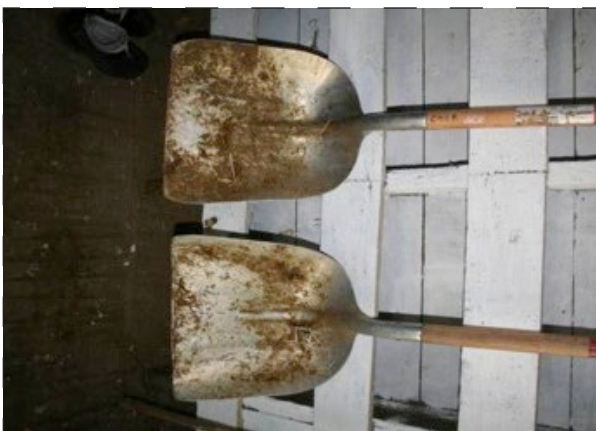
Tuberculosis (TB)

- Tuberculosis is caused by the bacterium *Mycobacterium*. Different strains of the bacteria can infect humans, birds, and cattle.
- *Mycobacterium bovis* primarily infects cattle, but can also infect deer, goats, elk, and swine, as well as humans.
- Many cattle infected with bovine TB do not show symptoms. However, some infected cattle may not eat and may become emaciated and weak and develop a fever.
- There are a variety of ways bovine TB can be passed from one animal to another, depending on where the infection occurs in the body. If the infection is in the digestive tract, cattle will develop diarrhea and constipation and can spread the disease through their feces. If the respiratory tract is infected, cattle will have a wet cough in cold weather and can potentially develop respiratory distress. Infected animals can spread the disease through aerosol droplets when they cough.
- Bovine TB can also infect other cows indirectly through contaminated equipment or even a milking parlor that is not disinfected.
- It is possible for contaminated feces of an infected cow to be the source of fecal contamination in milk.
- Since TB can infect humans, humans have to be very careful with the foods they eat and the animals they touch.
- Humans are not natural hosts for bovine TB but they can catch the disease by drinking infected (usually unpasteurized) milk.
- Humans who drink infected milk may develop TB in the mouth, neck lymph nodes, and/or the intestine, but bovine TB does not infect human lungs. Lung infections come from the bacterium that usually causes human TB, *Mycobacterium tuberculosis*.
- Workers or farmers who work closely with infected cattle or infected carcasses have an increased chance of catching bovine TB, particularly from inhaling small aerosol droplets that contain the TB bacteria.
- Humans who touch or interact with animals and/or animal products that have the potential to carry *M. bovis* bacteria should wash their hands to prevent ingestion or passing of the bacteria.
- Humans who are around infected animals should wear masks to decrease the chance that they will inhale contaminated droplets in the air.

CRITICAL CONTROL POINT PICTURES

The Critical Control Point (CCP) pictures provided in this activity will include all the CCPs for all the diseases that are covered here. Youth will then have to search through the pictures and find the ones that best match the disease they have.





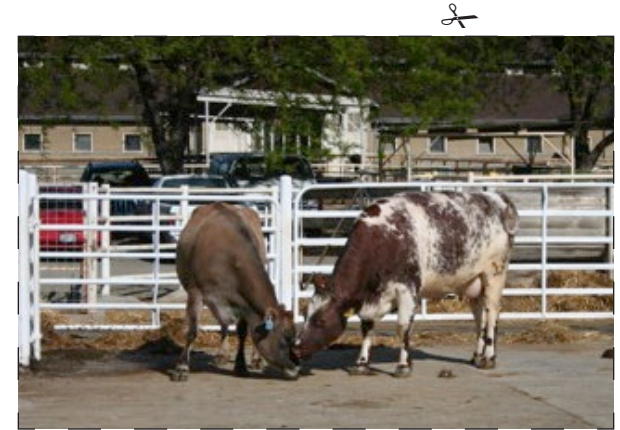
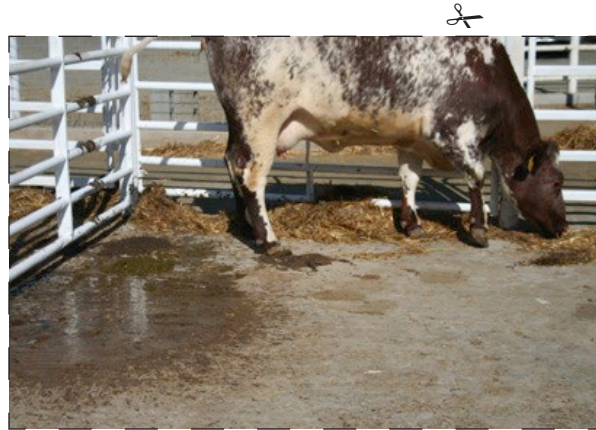


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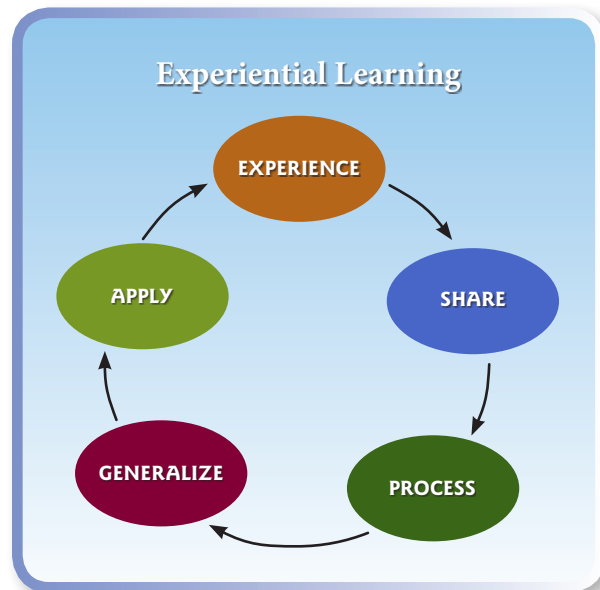
EAMON CURRY

Volunteers: Examples of Critical Control Points in Photographs

- Transportation
- Rakes, shovels
- Wheel barrels
- Water
- Ventilation
- Boots and clothing
- Flies
- Birds
- Feces
- Vermin
- High stocking density
- Run-off
- Food scraps
- Direct/indirect contact with like species
- Direct/indirect contact with unlike species

APPENDIX

The activities in this curriculum were designed around inquiry and experiential learning. Inquiry is a learner-centered approach in which individuals are problem solvers investigating questions through active engagement, observing and manipulating objects and phenomena, and acquiring or discovering knowledge. Experiential learning (EL) is a foundational educational strategy used in 4-H. In it, the learner has an experience phase of engagement in an activity, a reflection phase in which observations and reactions are shared and discussed, and an application phase in which new knowledge and skills are applied to a real-life setting. In 4-H, an EL model that uses a five-step learning cycle is most commonly used. These five steps—Experiencing, Sharing, Processing, Generalizing, and Applying—are part of a recurring process that helps build learner understanding over time.



For more information on inquiry, EL, and the five-step learning cycle, please visit the University of California Science, Technology, and Environmental Literacy Workgroup's Experiential Learning website, <http://www.experientiallearning.ucdavis.edu/default.shtml>.

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Pre-Harvest Food Safety in 4-H Animal Science

Part 2: Food-Producing Animal Selection and Pre-Harvest Food Safety Considerations

OVERVIEW AND BACKGROUND INFORMATION

Pre-Harvest Food Safety involves following specific practices in the pre-harvest environment in order to reduce the risks that livestock and poultry will contract pathogens and diseases that can subsequently pose a threat to human health. By the **pre-harvest environment**, we mean everything that happens from the producer's acquisition of an animal until the food product is collected (e.g., milk or eggs) or harvested (e.g., meat). Preventive measures include the initial selection of healthy livestock, proper husbandry, appropriate use of antibiotics and other pharmaceuticals, and other disease prevention measures.

Pre-harvest food safety is an important component of animal agriculture. Failure to follow proper pre-harvest food safety guidelines can result in the illness and even death of both livestock and people. It is the responsibility of everyone who raises food animals to take proper precautions to ensure the safety of the food supply. These precautions begin with the acquisition of a healthy food-producing animal. Such an animal should originate from a safe and sanitary, **pathogen-free** environment with a low **stocking density**. Additionally, the animal should be transported safely in a vehicle with adequate **ventilation** and should have a health record that includes past and current vaccinations, any **antibiotic** use, and no history of any serious illnesses.

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Activity Concepts and Vocabulary:

- **Antibiotic:** A chemical substance, produced by a microorganism, that has the capacity to inhibit the growth of or to kill other microorganisms. Antibiotics that are sufficiently nontoxic to the host are used in the treatment of infectious diseases.
- **Critical Control Point:** A point, step, or procedure in the course of growing food where humans can introduce a process that can help prevent, eliminate, or reduce a food safety hazard.
- **Pathogen:** A disease-causing organism.
- **Pre-Harvest Environment:** Any and all factors associated with the acquisition and raising of a food-producing animal until such time as the associated food product is collected (e.g., milk or eggs) or harvested (e.g., meat).
- **Pre-Harvest Food Safety:** Safety measures taken that reduce the risk that pathogens associated with livestock and poultry food products that can adversely affect human health will enter the food supply.
- **Stocking Density:** The number of animals in a given amount of space.
- **Ventilation:** The movement of air through an area.

Life Skills

- **Head:** Keeping records, critical thinking, problem solving, decision making
- **Heart:** Sharing, cooperation, communication
- **Hands:** Contributions to a group effort, teamwork
- **Health:** Disease prevention

Subject Links

Science, Language Arts

Next-Generation Science Standards (NGSS)

Crosscutting Concepts

- **Patterns:** Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- **Cause and Effect:** Events have causes, sometimes simple, sometimes multi-faceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

Purpose of Activity

The purpose of this activity is to have youth learn the best practices associated with raising a healthy animal prior to its harvest. In addition, the goal is to have youth learn the importance of acquiring a healthy animal by

knowing the background information on the animal as well as looking for characteristics of a healthy animal. Having this knowledge, youth will increase their chances of raising a healthy animal and the chances that it or its products will be safe for human consumption.

Overview of Part 1: Choosing a Calf

In Part 1, the youth will go through a simulated process of obtaining a calf for a 4-H project that will eventually be marketed and harvested for human consumption. As the youth learn more about their animal, they will identify potential disease risks that their animal has experienced. The youth will identify critical control points in the calf's history and explain how these points might be related to disease transmission.

Overview of Application, Part 1: Which calf am I going to pick?

After completing Part 1, youth will receive a **Pre-Harvest Food Safety Risk Checklist** that they will use to review animals that are available for purchase. Given a few options, youth will assess the animals' records, site and transportation history, will choose a calf to purchase, and will explain their reasons for making that particular choice.

Overview of Application, Part 2

After completing Application Part 1, youth will have the opportunity to apply the **Pre-Harvest Food Safety Risk Checklist** to their own food-producing animal or to a friend's food-producing animal.

PART 1: CHOOSING A CALF

Time Required

30–45 minutes

Suggested Grouping

Pairs or small groups (as many as five pairs or groups)

Materials Needed

(* = Materials provided in curriculum)

- * *Calf Profiles* (each includes a calf picture, transportation, site and record information)
- * *Recording Sheet*
- * *Pre-Harvest Food Safety Risk Checklist*
- Pens or pencils; markers
- Flipchart paper

Getting Ready

- Make enough copies of *Calf Profiles* so each group gets one.
- Make enough copies of *Recording Sheet* and the *Pre-Harvest Food Safety Risk Checklist* for each group.
- Make certain each group has an adequate supply of writing utensils and flipchart paper.

Opening Questions

1. **What does the term “risk” mean to you?** Ask the youth to share their ideas verbally or write their thoughts and ideas on the paper provided.
2. **Why, do you think, it is important to keep your food-producing animals healthy?** Ask the youth to share their ideas verbally or write their thoughts and ideas on the paper provided.

3. **What does the term “food safety” mean to you?** Ask the youth to share their ideas verbally or write their thoughts and ideas on the paper provided.
4. **What do you think are some risks related to food safety?** Ask the youth to share their ideas verbally or write their thoughts and ideas on the paper provided.

Procedure (Experiencing)

1. Start by explaining to the youth that they are going to be given, at random, a calf for a market 4-H project. They are to raise the calf, and eventually it will be harvested for human consumption.
2. Give each group a *Recording Sheet*.
3. Choose at random one *Calf Profile* for each group, and distribute them accordingly.
4. Looking at the information provided on the *Calf Profiles* about their calf, ask each group to identify what they believe are that animal’s pre-harvest food safety risks within each category (records, site, and transportation) that might lead to their calf contracting an illness.
5. Have youth record their observations on their *Recording Sheet*. Additionally, ask them to discuss ways they might be able to reduce these pre-harvest food safety risks, and to record these under “Suggestions of Ways to Reduce Risks” on the *Recording Sheet*.
6. Pass out a copy of the *Pre-Harvest Food Safety Risk Checklist* to each group. Have the youth compare the information they have recorded on their *Recording Sheet* with the *Pre-Harvest Food Safety Risk*

Checklist. Are there any similarities or differences? Ask the youth to share their ideas verbally or write their thoughts and ideas on the paper provided.

Sharing, Processing, and Generalizing

Follow the lines of thinking developed by the youth as they share and compare their thoughts and observations; if necessary, use more-targeted questions as prompts to get to particular points. Specific questions might include

1. As a group, share your thoughts on how the information you collected from the *Recording Sheet* could be important in the context of pre-harvest food safety.
2. If you had had the opportunity to choose your calf yourself, would you have chosen the calf you were given at the beginning of this activity? Why or why not? Please explain.
3. How do you think the factors listed on the *Pre-Harvest Food Safety Risk Checklist* help protect humans and animals from potential diseases in food products? Please explain.

Concept and Term Introduction

At this point, volunteers need to ensure that the concepts and terms **critical antibiotics, critical control points, pathogen, pre-harvest environment, pre-harvest food safety, stocking density, and ventilation** have been introduced. (Note: The goal is to have the youth develop these concepts through their own exploration and define the terms using their own words.)

APPLICATION PART 1: WHICH LAMB AM I GOING TO PICK?

Time Required

30–45 minutes

Suggested Grouping

Pairs or small groups (as many as five pairs or groups)

Materials Needed

(* = Materials provided in curriculum)

- * *Lamb Profiles* (each includes a lamb picture, record, transportation, and site information)
- * *Pre-Harvest Food Safety Risk Checklist*
- * *Risk Sheet*

Getting Ready:

- Make enough copies of *Lamb Profiles* so each group gets a set (all 5 lambs).
- Make enough copies of *Pre-Harvest Food Safety Risk Checklist* so each group gets 5 copies.
- Copy one *Risk Sheet* for each group.

Procedure (Experiencing)

1. Start by explaining to the youth that they are going to be choosing a lamb for a market 4-H project. Let the youth know that the lamb they select will eventually be harvested for human consumption.
2. First, have each group review the *Pre-Harvest Food Safety Risk Checklist*.
3. Give each group a set of *Lamb Profiles* and a *Risk Sheet*.
4. Each group will be given an opportunity to look at the records of 5 lambs before they choose their lamb.
5. As a group, have the youth review all of the *Lamb Profiles* and use the *Pre-Harvest Food Safety Risk Checklist* to help choose the animal they would like to purchase.
 - » (**Volunteer Tip:** When choosing their animal, youth can use a separate *Pre-Harvest Food Safety Risk Checklist* for each animal they review).
6. For their chosen animal, have each group determine the animal's pre-harvest food safety risks and write them down on the *Data Sheet*. Then, if possible, have the group determine how to reduce those risks.

Sharing, Processing, and Generalizing

Follow the lines of thinking developed by the youth as they share and compare their thoughts and observations; if necessary, use more-targeted questions as prompts to get to particular points. (**Volunteer Tip:** During this discussion, the youth should reach the conclusion that there is no “right” answer for this activity. Unless they find a case where an animal has no risk factors at all, the exercise of choosing an animal is always about considering options and weighing various risks).

Specific questions for each group might include:

- **Which animal did you pick and why did you choose that animal?**
- **For the animal you chose, what did you identify as potential pre-harvest food safety risks? How did you weigh different alternatives and how did you prioritize risk factors. What are some ways to reduce these risks?**
- **How do you think you might go about obtaining the type of information discussed in this activity when you need to choose a real project animal? Please explain.**

APPLICATION PART 2:
CONSIDERATIONS TO HELP REDUCE RISK OF DISEASE SPREAD
WHEN OBTAINING AND TRANSPORTING FOOD-PRODUCING ANIMALS

1. Use the *Pre-Harvest Food Safety Risk Checklist* to assess the records of your actual food-producing animal or the food-producing animal of someone you know.
2. Determine the critical control points that might apply to your animal and identify ways to reduce risks to the animal at these points.

CALF PROFILES

CALF A



<https://www.flickr.com/photos/unitedsoybean/9622288195/s>

Records

- Born in Canada, transported to California
- Has no vaccinations
- Gaining weight steadily
- No signs of sickness in the herd or animal

Site Where Calf Was Obtained

- High stocking density
- Clean food and water
- Not exposed to wildlife
- Housed in a barn; well ventilated
- Clean bedding
- Facility cleaned three times a day
- No vermin

Transportation from Site to 4-Her's Home

- Motor vehicle — travels in the family van
- Poor ventilation
- Transported alone
- No drainage in the van
- Carpet flooring — non-slip
- Adequate protection from the sun and rain
- Van not sanitized prior to transport

CALF B



<http://www.flickr.com/photos/otterpix/2861573452/> Pamela

Records

- Born on site, never transported
- Has all vaccinations
- Losing weight rapidly
- Animal exhibits some symptoms of intestinal distress (e.g., diarrhea); in the animal but not in the herd.

Site Where Calf Was Obtained

- Low stocking density
- Clean food and water, but not changed daily
- Some exposure to wildlife
- Housed in a barn; limited ventilation, only one opening and no fans
- Clean bedding
- Facility cleaned once a day
- Lots of crows and crow feces

Transportation from Site to 4-Her's Home

- Semi-trailer with jagged edges on inside
- Poor ventilation
- Transported alone
- Adequate drainage
- Metal floor; no rubber mat
- Poor protection from sun and rain
- Trailer sanitized prior to transport

CALF C



<http://www.flickr.com/photos/66176388@N00/2385870454/> Mark Robinson

Records

- Born on site, never transported
- Has some vaccinations, but not all
- Gaining weight very rapidly
- Exhibited signs of ringworm, but has been treated

Site Where Calf Was Obtained

- High stocking density, crowded with other cows
- Dirty water and food
- Not exposed to wildlife
- Housed in a barn; moderate ventilation with fans
- Dirty bedding
- Facility cleaned every other day
- Lots of flies

Transportation from Site to 4-Her's Home

- Pick-up truck with enclosure
- Adequate ventilation
- Transported with different species
- Poor drainage
- Wooden floor without rubber mat
- Adequate protection from sun
- Truck not sanitized prior to transport

CALF D



<http://www.flickr.com/photos/boynton/295333640/> Lucy Boynton

Records

- Born on site, never transported
- Has some vaccinations, but not all
- Trouble gaining weight
- No signs of sickness in the herd or animal

Site Where Calf Was Obtained

- Low stocking density
- Clean food and access to pond water
- Lives on pasture; exposed to wildlife
- No barn available
- No bedding available
- Lots of vermin

Transportation from Site to 4-Her's Home

- Double-stacked trailer
- Adequate ventilation
- Transported with same species
- Adequate drainage
- Metal floor with rubber non-slip mat
- Adequate protection from sun and rain
- Trailer sanitized prior to transport

CALF E



<https://www.flickr.com/photos/pinti1/7809394940/>

Records

- Born on site, never transported
- Fully vaccinated
- Gaining weight appropriately
- No signs of sickness in the herd or animal

Site Where Calf Was Obtained

- Low stocking density
- Clean food and water provided
- Wildlife is kept out with double fencing
- Excellent ventilation
- Lives on pasture; shelter available
- Clean bedding
- Shelter and bedding cleaned twice a day
- Some flies

Transportation from Site to 4-Her's Home

- Single-stack trailer
- Adequate ventilation
- Transported with cattle and pigs from the same farm
- Adequate drainage
- Metal floor with rubber non-slip mat
- Poor protection from sun and rain
- Trailer not sanitized prior to transport

Recording Sheet

Calf _____	Pre-harvest food safety risks	Suggested ways to reduce risks
Transportation		
Site		
Records		

LAMB PROFILES

LAMB A



<http://www.flickr.com/photos/11285577@N04/2840401565> Saxophone player

Records

- 65 days old, 70 lb
- Born on site, never transported
- Has some, but not all vaccinations
- Farmer has never sold club lambs
- Gaining weight steadily
- Had foot rot but received antibiotic treatment

Site Where Calf Was Obtained

- High stocking density
- Access to natural pond and clean food
- Lots of exposure to wildlife
- Lives on pasture; no shelter available
- Large presence of flies

Transportation from Site to 4-Her's Home

- Double-decker truck
- Smooth sides, no sharp edges
- Truck sanitized prior to transport
- Proper drainage and ventilation
- Used for sheep from one farm only
- Sheep are crowded into truck
- Protection from sun and rain

LAMB B



<http://www.flickr.com/photos/mdpettitt/445330317/> Martin Pettitt

Records

- 70 days old, 95 lb
- Born on site, never transported
- Has some vaccinations, but not all
- Farmer often sells club lambs
- Gaining weight steadily
- Foot rot in some of the herd, but no signs in this animal

Site Where Calf Was Obtained

- Low stocking density
- Clean water and food provided
- Close proximity to wildlife
- Housed in a barn; moderate ventilation with fans
- Clean bedding
- Facility cleaned twice a day
- Lots of crows

Transportation from Site to 4-Her's Home

- Pick-up truck
- Great ventilation
- Metal floors
- Proper drainage
- Multiple sheep from the same farm
- Traveling in separated sections
- Smooth gates and sides
- Truck sanitized prior to transport

LAMB C



<http://www.flickr.com/photos/ajy/3498158540/> Alistair Young

Records

- 65 days old, 40 lb
- Born in Iowa; transported to California
- Has no vaccinations
- Farmer often sells club lambs
- Gaining weight slowly
- No foot rot in herd

Site Where Calf Was Obtained

- Low stocking density
- Access to clean water at all times
- No exposure to wildlife
- Housed in a barn; plenty of ventilation, several fans
- Bedding cleaned every other day
- Sheep have a dry, draft-free pen for lambing
- Difficult to disinfect the facility
- Few vermin

Transportation from Site to 4-Her's Home

- Family van
- Sheep from multiple farms transported together
- Protection from sun and rain
- Adequate ventilation
- Wooden floor
- No drainage
- Van not sanitized prior to transport

LAMB D



<http://www.flickr.com/photos/timparkinson/263819208/> Tim Parkinson

Records

- 60 days old, 60 lb
- Born on site, never transported
- Has all vaccinations
- Farmer has never sold club lambs
- Gaining weight steadily
- No foot rot in herd

Site Where Calf Was Obtained

- High stocking density
- Dirty water and food
- Some exposure to wildlife
- Housed in a barn; inadequate ventilation
- Concrete flooring
- Dirty bedding
- Facility cleaned daily
- Rat infestation

Transportation from Site to 4-Her's Home

- Semi-trailer
- Limited ventilation
- Sharp edges
- Non-slip floor with proper drainage
- Traveling with chickens
- Trailer not sanitized prior to transport

LAMB E



http://www.flickr.com/photos/naritheole/2287086672/n_ole

Records

- 60 days old, 65 lb
- Born on site, never transported
- Has some vaccinations, but not all
- Farmer often sells club lambs
- Weight gain has slowed recently
- No foot rot in herd

Site Where Calf Was Obtained

- High stocking density
- Water and feed contaminated by manure
- Exposure to wildlife
- Housed in a barn; limited ventilation, no fans
- Soiled bedding
- Facility is not cleaned often
- Large presence of rats and birds

Transportation from Site to 4-Her's Home

- Double-decker trucks
- Proper ventilation
- Sheep are not crowded
- Protection from sun and rain
- Sheep from multiple farms transported together
- Non-slip floor with no drainage
- Trucks cleaned prior to transport

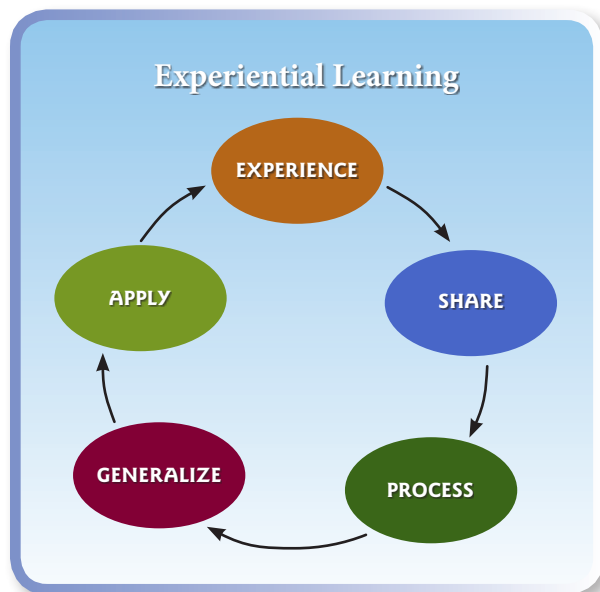
PRE-HARVEST FOOD SAFETY RISK CHECKLIST

Considerations to help reduce risk of diseases spread when obtaining and transporting food-producing animals

Transportation	When transporting your animal, look for:	✓
	No sharp edges	
	Well ventilated	
	Animal traveling alone	
	Sanitized vehicle	
	Well protected from harsh weather	
	Good drainage	
Site	When researching the site your animal came from, look for:	✓
	Low stocking density (the amount of animals in a given space)	
	Clean water and food	
	No exposure to wildlife	
	Well ventilated (example: open windows in barn)	
	Barn/shelter available	
	Clean bedding	
	Facility cleaned daily	
	Limited vermin (rats, flies, birds, etc.)	
Records	When reading through your animal's health records, look for:	✓
	Born on site	
	Fully vaccinated	
	Gaining weight steadily/appropriately	
	No signs of sickness in the herd or the animal	

APPENDIX

The activities in this curriculum were designed around inquiry and experiential learning. Inquiry is a learner-centered approach in which individuals are problem solvers investigating questions through active engagement, observing and manipulating objects and phenomena, and acquiring or discovering knowledge. Experiential learning (EL) is a foundational educational strategy used in 4-H. In it, the learner has an experience phase of engagement in an activity, a reflection phase in which observations and reactions are shared and discussed, and an application phase in which new knowledge and skills are applied to a real-life setting. In 4-H, an EL model that uses a five-step learning cycle is most commonly used. These five steps—Experiencing, Sharing, Processing, Generalizing, and Applying—are part of a recurring process that helps build learner understanding over time.



For more information on inquiry, EL, and the five-step learning cycle, please visit the University of California Science, Technology, and Environmental Literacy Workgroup's Experiential Learning website, <http://www.experientiallearning.ucdavis.edu/default.shtml>.

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Pre-Harvest Food Safety in 4-H Animal Science

Part 3: Raising and Protecting a Healthy Animal

OVERVIEW AND BACKGROUND INFORMATION

Raising animals and producing animal products for sale to market can be a very rewarding but challenging experience. Today, most food products on the shelf of the local supermarket are human-managed productions.

The process of **food harvesting** is vital because it affects public food safety.

Proper **management** is an essential part of good herd health as well. The

World Health Organization (WHO) advises that pre-harvest food safety is an essential element of any sustainable animal production and integrated food safety system.

The goal of **pre-harvest food safety** is to reduce public health risks along the entire food supply chain. We accomplish this by educating those who raise food animals, teaching everyone in the food supply chain methods for **prevention of disease transmission**, and reaching out to consumers by educating them about how to prevent foodborne illnesses. Pre-harvest food safety includes preventing foodborne pathogens from entering and infecting livestock that will be used for human consumption. Specific precautions and procedures taken during a food animal's life will help ensure the safety of the food for human consumption. Such precautions may include treating animals with antibiotics, proper waste management, regulating temperatures to suit specific species, and having fresh food and water readily available. By following these precautions, one can prevent the transmission of foodborne illnesses and at the same time create a safer environment for the animal. If an animal is suspected to have an illness, it should be **quarantined** for a period of time to make sure it is in good health before harvesting it or its products for human consumption.

Self-assessment on the part of the food animal producer is very important. Before an animal is acquired, careful self-assessment to identify the food animal project best suited for the 4-H member is important. Self-assessment includes researching the space and housing available for the animal, determining how much time and labor the youth can realistically expect to be able to commit, finding out what types of feed are available, and a number of other factors. Each species, and even individual breeds within a single species, presents its own unique set of needs.

Pre-harvest food safety is a form of **bio-security** that must be taken seriously. These practices are most effective when done with consistency and accuracy. Not only animal assessment and self-assessment (**Disease Transmission Risk Assessment**) are important, though; record-keeping that is kept current is also critical. Good records ensure that an owner is familiar with the diseases that are common to each animal, as well as the measures he or she needs to take in order to ensure that no disease is transmitted to humans or animals. Many animals are susceptible to disease, so the main focus of pre-harvest food safety is to prevent diseased food products from being passed along for human consumption.

Activity Concepts and Vocabulary

- **Bio-security:** Precautions taken to protect a living thing (e.g., humans, animals, or plants) from attack or interference due to biological organisms that have the potential to cause the harm (or, in less formal terms, “Keeping the bad bugs off the farm”).
- **Direct transmission:** Physical contact between an ill person or animal and a healthy person or animal that leads to the transmission of a disease.
- **Indirect transmission:** The transfer of pathogens to an uninfected person or animal through contact with the contaminated surface of an inanimate object (e.g., a food dish; the floor of a transport trailer).
- **Disease Transmission Risk Assessment:** An evaluation of the chance or likelihood that a disease will spread or will infect humans or animals.
- **Management:** The act or manner of handling, direction, or control of an animal’s care.
- **Pathogen:** A disease-causing organism.
- **Pre-harvest Food Safety:** The reduction of risks associated with pathogens’ effects on the livestock and poultry that enter the human food supply, with the potential to adversely affect human health.
- **Prevention:** Keeping something from occurring or happening.

- **Quarantine:** Isolation of infected animals to keep them away from others and so prevent the spread of disease.
- **Self-assessment:** Determination, by an individual, of what his or her animal’s needs are and what the individual is capable of doing to raise an animal.

Life Skills

- **Head:** Keeping records, critical thinking, problem solving
- **Heart:** Sharing, cooperation, communication
- **Hands:** Contributions to a group effort, teamwork
- **Health:** Disease prevention, personal safety

Subject Links: Science, Language Arts

Next-Generation Science Standards (NGSS)

Crosscutting Concepts

- **Cause and Effect:** Events have causes, sometimes simple, sometimes multi-faceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- **Scale, Proportion, and Quantity:** In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system’s structure or performance.

Purpose of Activity

The purpose of this activity is to have youth learn the requirements for raising a healthy animal for harvest. An additional goal is to have youth learn the importance of protecting their animals, pre-harvest, from interactions with wildlife by demonstrating various ways their animals might contract diseases from these interactions and compromise their health.

Overview of Activity

This outdoor activity focuses on the components necessary to raise a healthy pre-harvest animal, including the importance of providing adequate space for the animal as well as the prevention of disease. The youth will simulate the daily life of an animal by going to and from different parts of their home as four groups of animals. In this way they will learn about **indirect contact**. After each round of the activity, the space available for the youth will be reduced, eventually reaching the point where there is so little space available that **direct contact** is unavoidable. The youth will have a chance to get an idea of what feels comfortable for an animal. Once the leader announces which group is infected or wild and which group has been vaccinated, the youth will get a better idea of their risks of being infected and what they can do to prevent this infection.

Time Required: 35–40 minutes

Suggested Grouping: 4 small groups

Materials Needed

(* = *Materials provided in curriculum*)

- * *Activity Stations: Bedding, Grooming, Water, Food*
- * *Group Cup Labels: A, B, C, D*
- * *Group's Station Letters: A, B, C, D*
- * *Letter Pieces: A, B, C, D*
- * *Blank Pieces*
- * *Recording Sheets*
- * *Set-up Map*
- Chalk (**Volunteer Tip:** If you would like to make this an indoor activity, you can find an appropriate substitute for the chalk, such as yarn, tape, paper bags, etc.)
- 8 plastic cups
- Flipchart paper
- Writing utensils
- Tape

Getting Ready

- Refer to the *Setup Map* to help set up this activity. Using your chalk, draw a large rectangle.
 - » (**Volunteer Tip:** If you have about 12 youth, there will be 4 groups of 3 youth, so you should outline

a 12' × 12' rectangle. If you have about 20 youth, there will be 4 groups of 5, so a 20' × 20' rectangle will be better.)

- Take the 4 labels for *Activity Stations: Bedding, Grooming, Water, Food* and place one on the middle of each sideline of the rectangle.
- Make at least 2 copies of the *Letter Pieces*. Cut out the pieces and fold each one inward so the letters are not visible. Then place a few of each letter in each of 4 plastic cups. Place a cup on the middle of each side of the rectangle.
- Place each *Group's Station Letters* on each corner of the rectangle.
- Cut out the *Group Cup Labels*. Tape them onto the remaining 4 cups. Place these 4 cups at the corner of the rectangle that corresponds to each group's station letters.
- Cut out the *Blank Pieces* and fold them.
- Cut the *Recording Sheets* on the dotted line.
- Explain the procedure, the *Letter Pieces*, and the *Recording Sheets* before you divide the youth into groups. The letter pieces that the groups pick up at each station represent one of the four animals each group represents.

Opening Questions:

1. **What do you think are ways you get sick? How can you protect yourself from getting sick?** Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.
2. **What do you think are ways animals get sick? How can you protect animals from getting sick?** Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.

Procedure (Experiencing)

Round 1

1. Before starting Round 1, put all *Blank Pieces* in the *Bedding* cup. Place the *Lettered Pieces* in the *Water*, *Food*, and *Grooming* cups.
2. Divide the youth into 4 groups and assign each group a letter (A, B, C, or D). Each group represents one animal.
3. Distribute the appropriate *Recording Sheets* to each group based on their letter assignment. Ask the youth to look at the *Recording Sheet's* example row and make sure they understand how to use the *Recording Sheets*.
4. Have each group stand at the corner that corresponds to their group letter. Have the members of each group lock arms with each other.
5. With arms locked and as a group, have Groups A, B, and C go to each of the 4 Activity Stations. Have Group D go to all of the Activity Stations EXCEPT Grooming. At each station, ask the youth to pick up one folded slip of paper for their group from the cup, one group at a time, and bring it back to their corner to place in their group's cups. Once they have

collected all their slips and returned to their corners, have them open up the folded slips they collected during this round and write down the information on their *Recording Sheet*.

» **(Leader Tip:** If the youth ask about the *Blank Piece* and how to record it, just tell them to leave that space blank. **Note:** By locking arms, the youth simulate a higher stocking density.)

6. Discard all of the *Letter Pieces* the groups have collected from each station during this round.

Round 2

1. Use the chalk to reduce the size of the activity area by at least 50% and realign all of the cups and stations to fit this reduced size.
2. Before you start Round 2, put all *Blank Pieces* in the *Food* cup. Place the *Lettered Pieces* in the *Water*, *Bedding*, and *Grooming* cups.
3. With arms locked and as a group, have Groups A, B, and C go to all 4 Activity Stations. Have Group D go to all of the Activity Stations EXCEPT Grooming. At each station, ask the youth to pick up one folded slip of paper for their group from the cup, one group at a time, and bring it back to their corner to place in their group's cups. Once in their corners, have them open up the pieces of paper they collected during this round and write down the information on their *Recording Sheet*.

» **(Leader Tip:** If the youth ask about the *Blank Piece* and how to record it, just tell them to leave that space blank. **Note:** The blank piece of paper represents a potential pathogen-free interaction.)
4. Discard all of the *Letter Pieces* the groups have collected from each station during this round.

Round 3

1. Use the chalk to reduce the size of the activity area again by at least 50%, and realign all of the cups and stations to fit this reduced size.
2. Before you start Round 3, put all the *Blank Pieces* into the *Grooming* cup. Place the *Lettered Pieces* in the *Water*, *Bedding*, and *Food* cups.
3. With arms locked and as a group, have Groups A, B, and C go to each of the Activity Stations. Have Group D go to all of the Activity Stations EXCEPT Grooming. At each station, ask the youth to pick up one folded slip of paper for their group from the cup, one group at a time, and bring it back to their corner to place in their group's cups. Once in their corners, have them open up the pieces of paper they collected during this round and write down the information on their *Recording Sheet*.

» **(Leader Tip:** If the youth ask about the *Blank Piece* and how to record it, just tell them to leave that space blank.)
4. Discard all the *Letter Pieces* the groups collected from each station during this round.

Round 4

1. Use the chalk to reduce the size of the activity area again by at least 50%, and realign all of the cups and stations to fit this reduced size.
2. Before you start Round 3, put all *Blank Pieces* in the *Water* cup. Place the *Lettered Pieces* in the *Grooming*, *Bedding*, and *Food* cups.
3. With arms locked and as a group, have Groups A, B, and C go to each of the Activity Stations. Have Group D go to all of the Activity Stations EXCEPT

Grooming. At each station, ask the youth to pick up one folded slip of paper for their group from the cup, one group at a time, and bring it back to their corner to place in their group's cups. Once in their corners, have them open up the pieces of paper they collected during this round and write down the information on their *Recording Sheet*.

» **(Leader Tip:** If the youth ask about the *Blank Piece* and how to record it, just tell them to leave that space blank).

4. At the end of Round 4, announce to the youth that Group D was a wild animal infected with a disease. Have each group look at their *Recording Sheets* and circle the round(s) where they came into contact with Group D.

Final Round

1. Now, announce to the youth that Group A was vaccinated and that they are safe and disease-free.
2. Finally, ask the youth to discuss in their small groups what they can interpret from all the data they collected and were given.

Sharing, Processing and Generalizing

Ask the youth to interpret the information they wrote on their *Recording Sheets* throughout the activity. Follow the lines of thinking developed by the youth as they share and compare their thoughts and observations; if necessary, use more targeted questions as prompts to get to particular points. Specific points might include

1. **What did each group record on their *Recording Sheets* and how did they interpret their data?**
2. **What do you think are some ways you (representing an animal) could have become infected with a disease in this activity?**

3. **What do you think are some ways to reduce the risk that you (representing an animal) will become infected with a disease?**
4. **How did your group's experience change when the space was reduced at each round? What do you think the size of the living space has to do with disease transmission?**
5. **What role do you think the Blank Pieces played in this activity? What happened when you picked a Blank Piece? Why do you think there were no indirect contacts?**
6. **What does this activity teach you about potential pre-harvest food safety risks that might occur when you raise a real food-producing animal? What are some ways you can reduce these pre-harvest food safety risks?**

Concept and Term Introduction

At this point, volunteers need to ensure that the concepts and terms **bio-security, disease transmission, management, pathogens, pre-harvest food safety, prevention, quarantine, risk assessment, and self-assessment** have been introduced. (**Note:** The goal is to have the youth develop these concepts through their own exploration and define the terms using their own words.)

Concept Application

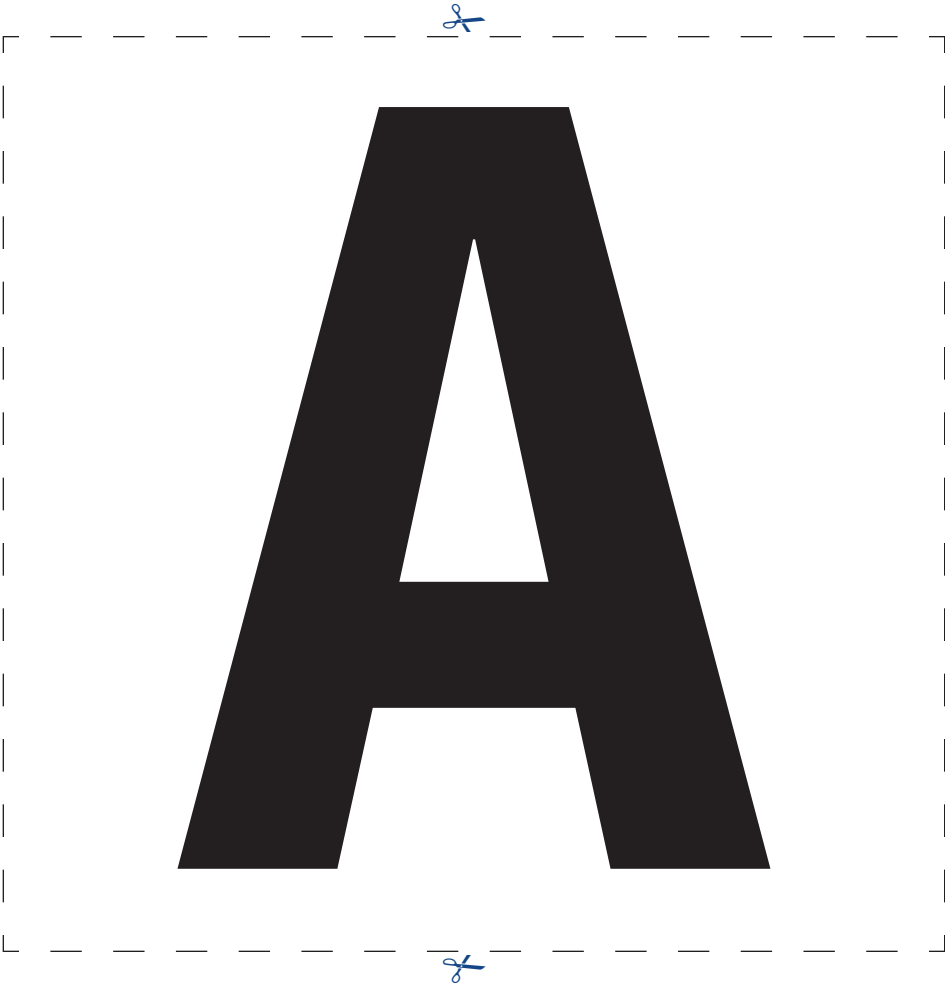
Ask the youth:

- **How would you design a living space for your animals to best meet their needs? Draw a picture of your proposed design. Consider space, sanitation, protection from wild animals, and pre-harvest food safety.**

REFERENCES

- Childers, A. B., and B. Walsh. Pre-harvest food safety. 1996. *Annals of New York Academy of Science*. (V. 791 Issue: Imaging brain structure and function: Emerging technologies in the neurosciences). Pp. 314–317. www.blackwell-synergy.com/doi/pdf/10.1111/j.1749-6632.1996.tb53538.x
- Davies, P. Pre-harvest food safety and pork. <http://mark.asci.ncsu.edu/HealthyHogs/book1994/davies2.htm>
- Dictionary.com. <http://dictionary.reference.com/>
- Safe Foods. Pre-harvest food safety and security. www.safefoods.nl/Lists/News/DispForm.aspx?ID=13
- U.S. Food and Drug Administration. Food protection plan. www.fda.gov/oc/initiatives/advance/food.html
- World Health Organization. Department of Communicable Disease, Surveillance and Response. Pre-harvest food safety. 2001. http://whqlibdoc.who.int/hq/2002/WHO_CDS_CSR_EPH_2002.9.pdf
- World Health Organization. Foodborne disease surveillance: Pre-harvest food safety. www.who.int/foodborne_disease/strategies/preharvest/en/index.html

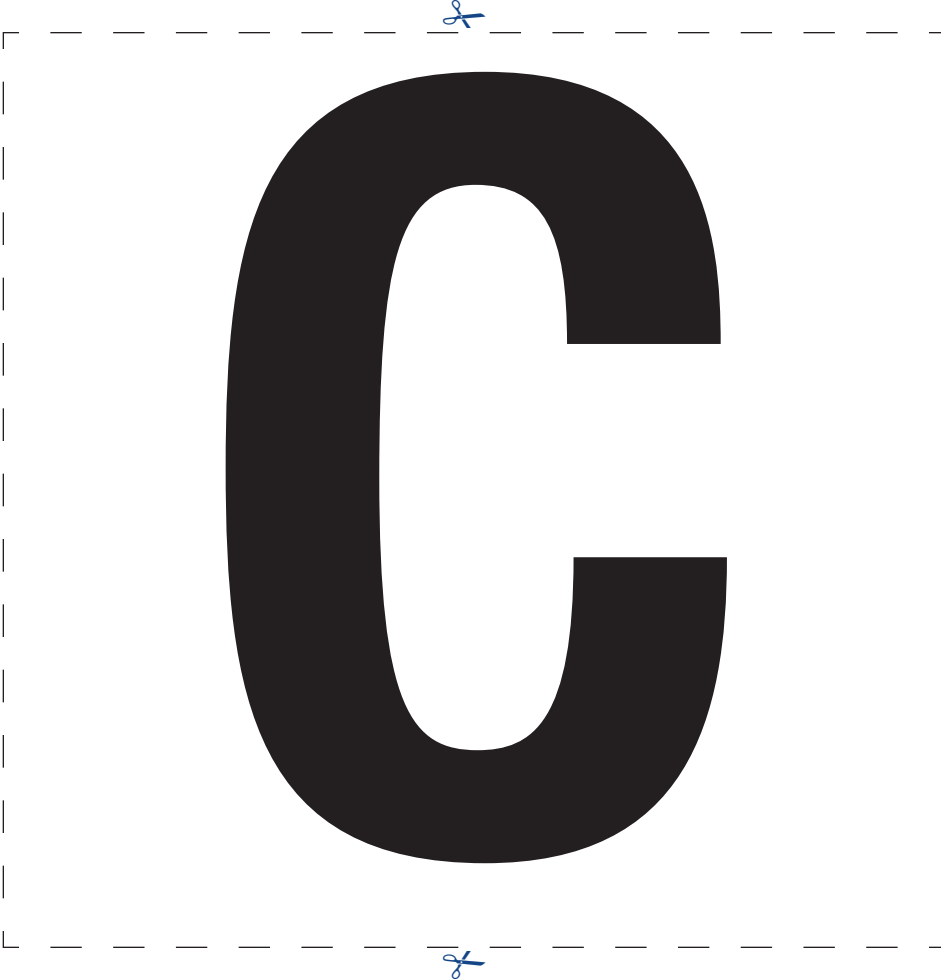
GROUP STATION LETTERS



A



B



C



D

ACTIVITY STATIONS



Food





Water





Bedding











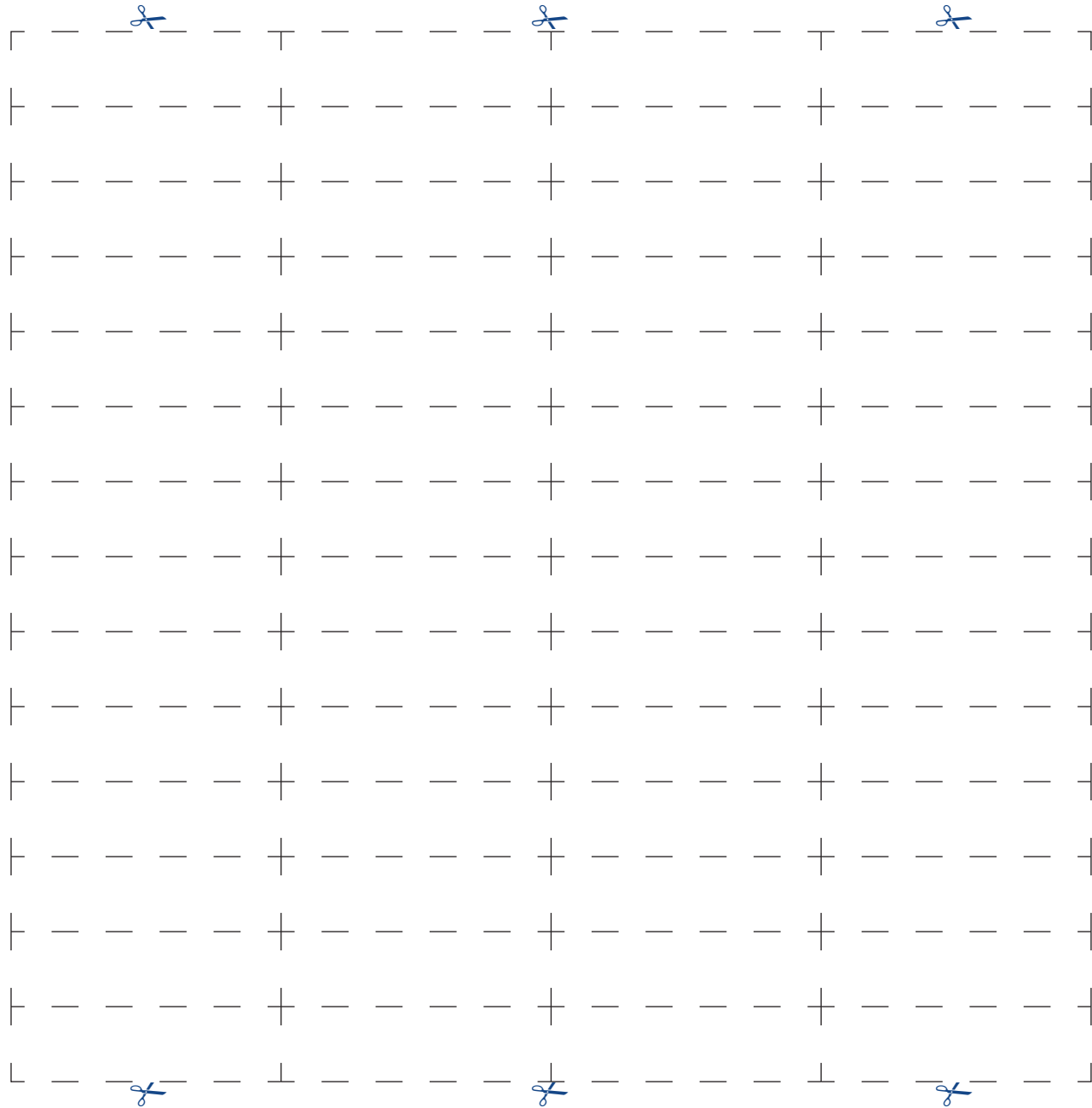
Grooming



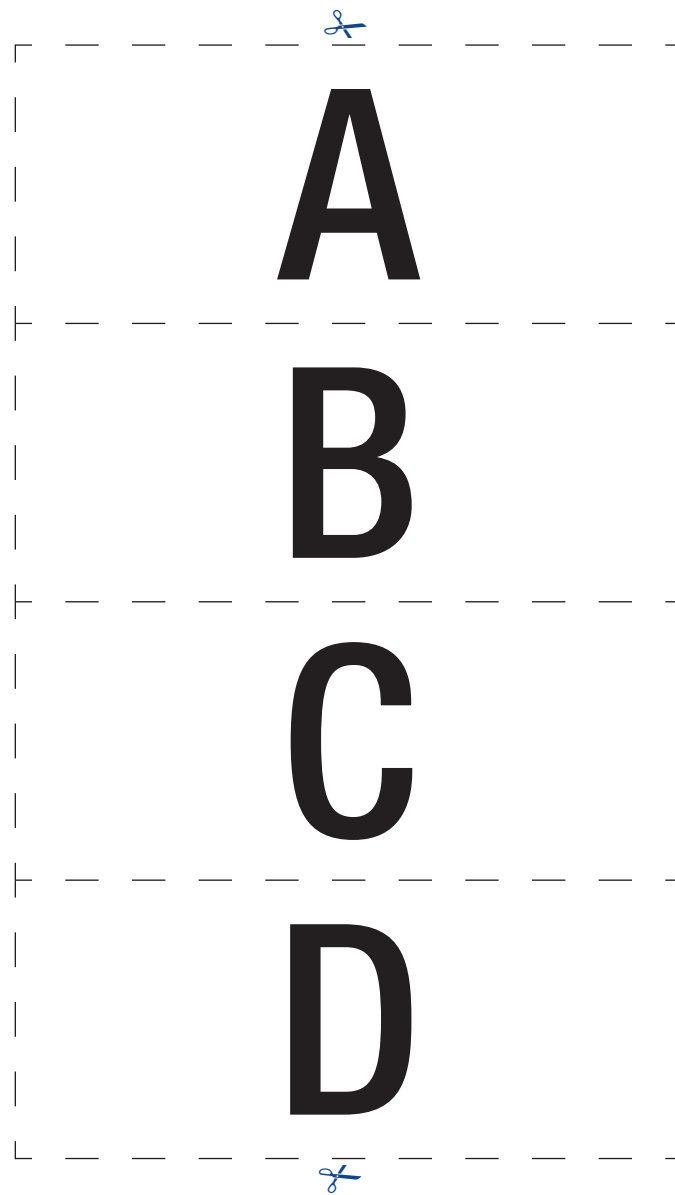
LETTER PIECES

	A		B		C		D	
	A		B		C		D	
	A		B		C		D	
	A		B		C		D	
	A		B		C		D	
	A		B		C		D	
	A		B		C		D	
	A		B		C		D	
	A		B		C		D	
	A		B		C		D	
	A		B		C		D	
	A		B		C		D	
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	A		B		C		D	
	A		B		C		D	

BLANK PIECES

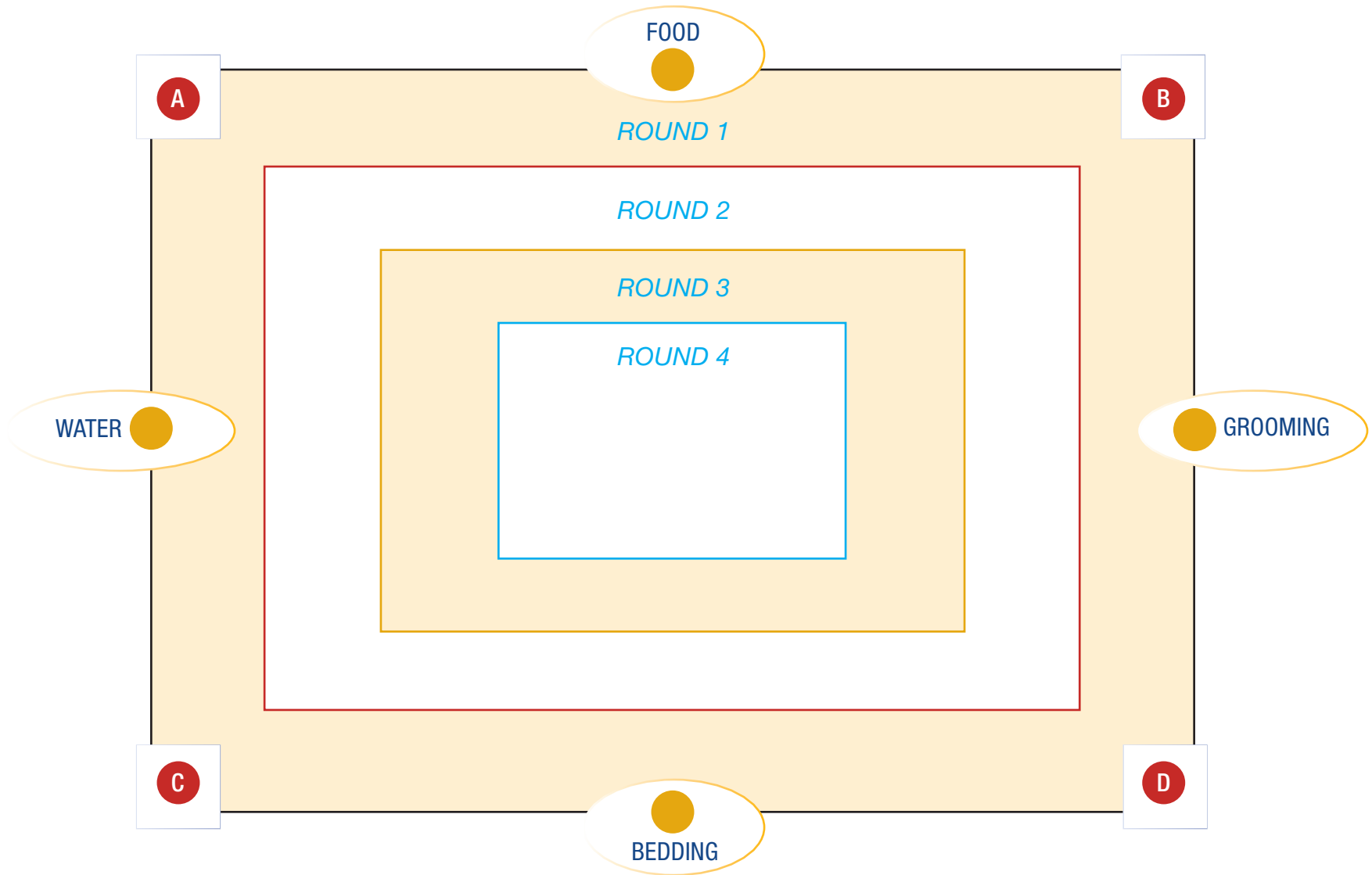


GROUP CUP LABELS



SET-UP MAP

- Group's station letters
- Cups with letter pieces in them



RECORDING SHEETS



ANIMAL A	Food	Water	Bedding	Grooming
<i>Example:</i>	<i>A</i>	<i>D</i>		<i>B</i>
Round 1				
Round 2				
Round 3				
Round 4				



ANIMAL C	Food	Water	Bedding	Grooming
<i>Example:</i>	<i>A</i>	<i>D</i>		<i>B</i>
Round 1				
Round 2				
Round 3				
Round 4				

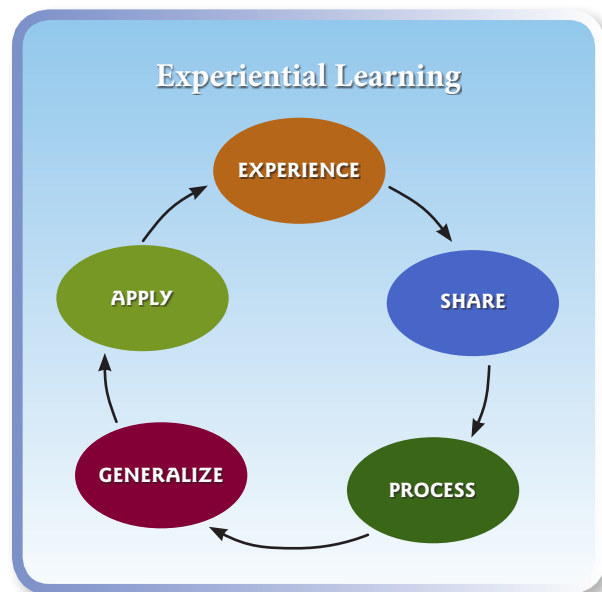
ANIMAL B	Food	Water	Bedding	Grooming
<i>Example:</i>	<i>A</i>	<i>D</i>		<i>B</i>
Round 1				
Round 2				
Round 3				
Round 4				

ANIMAL D	Food	Water	Bedding	Grooming
<i>Example:</i>	<i>A</i>	<i>D</i>	<i>B</i>	
Round 1				
Round 2				
Round 3				
Round 4				



APPENDIX

The activities in this curriculum were designed around inquiry and experiential learning. Inquiry is a learner-centered approach in which individuals are problem solvers investigating questions through active engagement, observing and manipulating objects and phenomena, and acquiring or discovering knowledge. Experiential learning (EL) is a foundational educational strategy used in 4-H. In it, the learner has an experience phase of engagement in an activity, a reflection phase in which observations and reactions are shared and discussed, and an application phase in which new knowledge and skills are applied to a real-life setting. In 4-H, an EL model that uses a five-step learning cycle is most commonly used. These five steps—Experiencing, Sharing, Processing, Generalizing, and Applying—are part of a recurring process that helps build learner understanding over time.



For more information on inquiry, EL, and the five-step learning cycle, please visit the University of California Science, Technology, and Environmental Literacy Workgroup's Experiential Learning website, <http://www.experientiallearning.ucdavis.edu/default.shtml>.

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Pre-Harvest Food Safety in 4-H Animal Science

Part 4: Decision-Making and Owner Responsibilities

OVERVIEW AND BACKGROUND INFORMATION

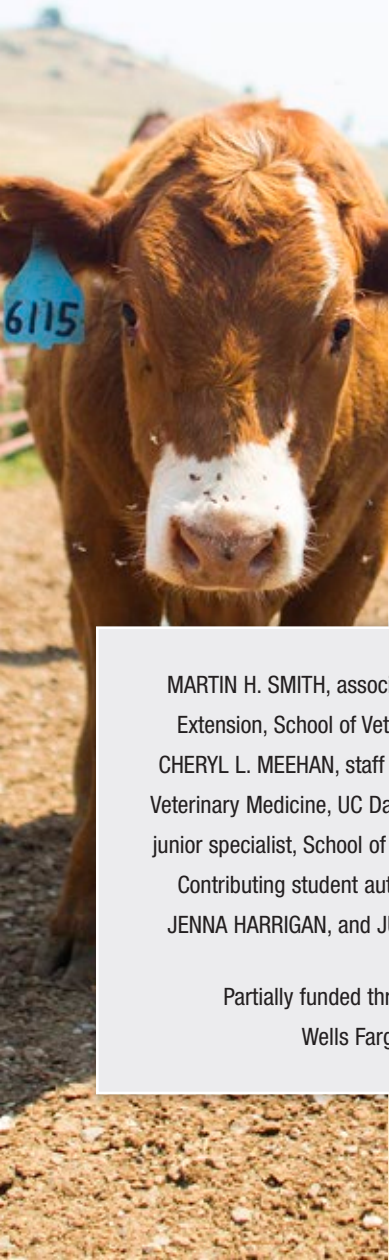
Seeking veterinary care for sick animals is very important. If a diagnosis requires a particular type of treatment, it is important to follow a licensed veterinarian's instructions to maximize the animal's chances for a full recovery. After treatment has been completed, a residue of the medicine may remain in the animal for a period of time. The time it takes for that residue to leave the animal is the **withdrawal period**, and it must be taken into consideration when raising and selling food-producing animals. It is important that no residues remain in the meat of any animal, or in any food products from the animal. Human consumption of these residues can be harmful.

An animal can get sick from harmful bacteria (i.e., those that can cause illness). One type of treatment against bacteria is the administration of antibiotics. There are two major types: **broad-spectrum** and **narrow-spectrum** antibiotics. Broad-spectrum antibiotics fight against a wide range of disease-causing bacteria, while narrow-spectrum antibiotics are only effective against specific families of bacteria.

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It is also very common for animals to be infected with parasites, both internal and external. There are many effective treatment options for parasites. However, choosing the right treatment option can get complicated when taking into consideration how the illness may affect exhibition of the animal at fairs, costs of medication and treatment, the medicines' withdrawal periods, and how those may affect selling the animals or animal products.

Activity Concepts and Vocabulary

- **Antibiotic:** A chemical substance, produced by a microorganism, that has the capacity to inhibit the growth of or kill other microorganisms. Antibiotics that are not toxic to the host animal are used to treat various infectious diseases.
- **Antibiotic resistance:** The ability of a microorganism to withstand the effects of antibiotic treatment.
- **Broad-spectrum antibiotic:** An antibiotic that is effective against a wide range of disease-causing bacteria.
- **Narrow-spectrum antibiotic:** An antibiotic that is effective against only specific families of bacteria.
- **Parasite:** An organism that lives in or on another organism and affects that organism in a negative way.
- **Withdrawal period:** The time period required to withhold an animal from slaughter or dispose of its milk after it has been treated with a medication.

Life Skills

- **Head:** Keeping records, planning/organizing, critical thinking, problem solving, decision making
- **Heart:** Sharing, cooperation, communication
- **Hands:** Contributions to group effort, teamwork
- **Health:** Disease prevention, personal safety, self-responsibility

Subject Links:

Science, language arts

Next-Generation Science Standards (NGSS)

Crosscutting Concepts

- **Cause and Effect:** Events have causes, sometimes simple, sometimes multi-faceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- **Patterns:** Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

Purpose of Activity

The purpose of this activity is to have youth understand the responsibilities of raising animals for human consumption. It is very important to know what is required in raising a healthy animal prior to harvest, as well as

to know what precautions need to be taken in the event an animal contracts an illness. The goal is to have the youth learn the importance of protecting their animal from prolonged illnesses, the recurrence of an illness, and the spread of illness to other animals. This activity demonstrates to the youth that even with a veterinarian's help and proper treatment, the responsibility of keeping a pre-harvest animal healthy may include very tough decisions, the outcomes of which can have lasting effects on the animal and on humans.

Overview of Part 1: Antibiotics

This activity focuses on the decision-making process for treating a sick animal. It emphasizes the importance of contacting a veterinarian and making decisions related to recommended treatments. Youth will make decisions based on the type of treatment, the length of the treatment, the withdrawal period for the treatment, as well as taking into consideration the scheduling of county fairs and shows. The youth will have the opportunity to understand how their decisions can affect the health of their animals.

Overview of Part 2: Parasites

Similar to Part 1, Part 2 focus on the decision-making process when treating animals infected with internal and external parasites. With suggestions from a veterinarian, the youth will need to think critically and take into consideration complex treatment options, withdrawal time periods, cost requirements, and fair dates when deciding how to treat an animal infected with parasites.

PART 1: ANTIBIOTICS

Time Required

40–60 minutes

Suggested Grouping

Pairs

Materials Needed

(* = Materials provided in curriculum)

- * Fair Information
- * Journal
- * Antibiotic Information
- * Animal Scenario
- * Blank Calendars
- Writing utensils
- Flip chart paper

Getting Ready

- Divide the youth into pairs.
- Make enough copies of *Fair Information*, *Journal*, *Antibiotic Information*, and *Blank Calendars* for each pair.
- Make enough copies of the *Animal Scenario* so each pair of youth gets a scenario.
- Make sure there are enough writing utensils and flip chart paper for each pair of youth.

Opening Questions

1. When you are sick and your doctor gives you medicine, why do you think it is important to follow your doctor's directions? Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.

2. When your animal is sick and the veterinarian gives you medicine to give to your animal, why do you think it is important to follow your veterinarian's directions? Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.
3. What do you think some of the consequences could be if you were not to follow your doctor's or your veterinarian's directions? Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.

Procedure (Experiencing)

1. Pass out a copy of the *Animal Scenario* to each pair.
2. Give each pair *Blank Calendars*, *Journal*, and *Fair Information* sheets.
3. Ask the youth to read through the *Fair Information* sheet. Have them write information mentioned on the *Fair Information* sheet on the corresponding dates on their *Blank Calendars*.
4. Next, ask each pair to choose the fair they would like to attend from the *Fair Information* sheet. Ask them to record which fair they have chosen and the reasons for their choice under Part 1 on their *Journal*.
5. Pass out the *Antibiotic Information* sheet and a copy of the *Animal Scenario* to each pair.
6. Give each pair time to read their *Animal Scenario*. Have them use their *Blank Calendars* to record any important new information.
7. Using the *Antibiotic Information* sheet and the information they recorded on their *Blank Calendars*, have each pair decide which antibiotic treatment

(broad-spectrum or narrow-spectrum) they would like to use on their animal, and record this information under Part 1 on their *Journal*.

8. Looking at the fair they chose in Part 1 of their *Journal*, have each pair discuss how their choice of antibiotic might affect their fair plans. Have them write their response under Part 1 on their *Journal*.

Sharing, Processing and Generalizing

Follow the lines of thinking developed by the youth as they share and compare their thoughts and observations. Ask the youth to share with the entire group the information recorded in their *Journal* regarding treatment for their animal and their choice of fair. If necessary, use more targeted questions as prompts to get to particular points. Specific questions might include

1. What do you think you need to consider before deciding on a treatment for your animals? Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.
2. What do you think are major factors to consider when choosing a fair? Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.
3. How might you think about situations similar to this in the future? How might this exercise help you when you plan future projects that involve food-producing animals? Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.

PART 2: PARASITES

Time Required

40–60 minutes

Suggested Grouping

Pairs

Materials Needed

(* = Materials provided in curriculum)

- * Parasite Chart
- * Parasite Scenarios
- * Blank Calendars
- * Fair Information
- * Journal
- Writing utensils
- Flip chart paper

Getting Ready

- Make enough copies of the *Parasite Chart* and *Blank Calendars* for each pair of youth to have one.
- Make enough copies of the *Parasite Scenarios* so each pair gets one scenario. Cut the scenarios out.
- Make sure there are enough writing utensils and sheets of flip chart paper for the youth.

Procedure (Experiencing)

- Randomly pass out one *Parasite Scenario* and a *Parasite Chart* to each pair. Have each pair write the type of animal they have on the *Journal* under Part 2.

- Ask the youth to read through the *Fair Information* sheet. Have them write information mentioned on the *Fair Information* sheet on the corresponding dates on their *Blank Calendars*.
- Next, ask each pair to choose the fair they would like to attend from the *Fair Information* sheet. Ask them to record the fair they have chosen and the reasons for their choice on the *Journal*.
- Ask the youth to read through their *Parasite Scenarios* and write down any important information on their new *Blank Calendar*.
- Using the information provided from the *Parasite Scenarios* and the *Parasite Chart*, have each pair decide which treatment option they would like to use on their animal and their reasons for making that choice. Have them record this information under Part 2 of their *Journal*.
- Looking at the fair they chose, have each pair discuss how their choice of treatment might affect their fair plans. Have them write their response under Part 2 of their *Journal*.

Sharing, Processing, and Generalizing

Follow the lines of thinking developed by the youth as they share and compare their thoughts and observations. Ask the youth to share with the entire group the information recorded in their *Journal* regarding their choice of treatment for their animal and their choice of fair. If necessary, use more targeted questions as prompts to get to particular points. Specific questions might include

1. How did each pair go about making a decision on the type of treatment for their animal? Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.
2. What do you think are major considerations when choosing a treatment option? Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.
3. How might you go about making similar decisions in the future with your own pre-harvest animal? Ask the youth to share their ideas verbally or write their thoughts and ideas on the flip chart paper provided.

Concept and Term Introduction

At this point, volunteers need to ensure that the concepts and terms **antibiotic**, **antibiotic-resistance**, **broad-spectrum**, **narrow-spectrum**, **parasite**, and **withdrawal period** have been introduced. (**Note:** The goal is to have the youth develop these concepts through their own exploration and define the terms using their own words.)

Concept Application

1. Ask the youth to think about their food animal(s). How do they think they would go about choosing a treatment option for their animal(s)?
2. Ask the youth to list factors that influence their decisions when choosing a treatment. Ask them to list the factors in order of importance (e.g., “1. Cost, 2. Withdrawal” would mean that the cost of the treatment is more important than the length of the withdrawal time).

Fair Information

Fair 1: July 4

Distance: 110 miles away from your home

This fair is show only. The registration fee is \$20 per animal and the prize money is \$80. Vet checks will be performed at arrival. Your animal must be healthy. Animals that are being treated for illnesses may not participate in the show. Animals that are still in their withdrawal period are welcome to register and participate.

Fair 2: July 14

Distance: About 25 miles away from your home

This fair will consist of a show and an auction. There is a low registration fee and a great chance to win in the show because few people travel to this fair. The prize money is \$100. There will not be vet checks and there is no requirement to declare whether your animal is taking any drugs.

Fair 3: July 22

Distance: About 180 miles away from your home

This fair is show only. There will not be vet checks and there is no requirement to declare whether your animal is taking any drugs. There are no registration fees but you are required to sign up all animals that are brought onto the fair ground. Prize money is about \$30 to \$35.

Fair 4: July 26

Distance: About 8 miles away from your home

This fair is hosting both show and auction. The registration fee is \$30 per animal. The show prize money is about \$45. Many people come to this fair because they want to purchase animals that are in excellent shape at the auction. If you have raised your animal well, you have a great chance at a high auction price for your animal! Animals that have been on medication and are still within their treatment or withdrawal period may not be registered or allowed to participate.

Fair 5: August 1

Distance: 150 miles away from your home

This fair will consist of both show and auction. Every year, this fair is very well known for its very large show money prize! Although there is a pricey registration fee, many participate year after year. There will be vet checks upon registration and drug records must be submitted. All terminal animals must be drug-free—no exceptions!

Fair 6: August 5

Distance: Only 50 miles away from your home

This will be a show only fair. All animals may participate with only a \$5 entrance fee. If your animal is

being medicated or is still in its withdrawal period, you must declare the drug(s) that you have given to your animal in order to participate. This show is well known as an event for just having a good time and showing off your great animals! There is no prize money.

Fair 7: August 19

Distance: 200 miles away from your home

This fair will have both show and auction. Fewer animals go to this fair so there is a greater chance of winning in the show. The prize money is about \$35 to \$40. Many animals are sold at this auction for high prices every year. All animals must be drug free. Registration fee is fairly small.

Fair 8: August 25

Distance: Very close (25 miles away)

This fair will consist of both show and auction. Prize money is \$100. Registration fee is \$15 per animal. Your animal must be healthy. Animals cannot be actively receiving medications. This fair has a reputation for being lax with respect to enforcement of rules and show arenas are often dirty.

JOURNAL

PART 1: ANTIBIOTICS

Animal: STEER

Fair choice: _____

Reasons why you chose this fair:

Antibiotic treatment: _____

Reasons why you chose this treatment:

Did your antibiotic choice affect your fair plans? Would you change anything about either your fair plan or your antibiotic choice? If so, how would you change it?

PART 2: PARASITES

Animal: _____

Fair choice: _____

Reasons why you chose this fair:

Please circle one: Internal Parasite or External Parasite

Parasite: _____

Treatment choice: _____

Reasons why you chose this treatment:

How did your treatment choice affect your fair plans? Would you change anything about either your fair plan or your treatment choice? If so, how would you change it?

ANTIBIOTIC INFORMATION

NARROW-SPECTRUM VS. BROAD-SPECTRUM ANTIBIOTICS

Narrow-Spectrum Antibiotics

Advantages:

- Accurately fights off a specific bacterial infection
- Decreases the chances the bacteria will develop antibiotic resistance
- Increases the chances for raising a healthy food-producing animal

Disadvantages

- Usually has a longer withdrawal period than a broad-spectrum antibiotic
- Only effective against a limited number of pathogens

Broad-Spectrum Antibiotics

Advantages:

- Active against a broader spectrum of bacteria
- There is less need to identify the infecting pathogen with great certainty before you treat
- Usually has a shorter withdrawal period than a narrow-spectrum antibiotic

Disadvantages:

- Greater chance that bacteria will develop antibiotic resistance
- Because of its more profound effect, it may interfere with the ability of the animal's beneficial microorganisms to fight off harmful bacteria, thus increasing the chances it will be infected by other pathogens

ANIMAL SCENARIOS

Steer

On July 8 you notice your steer is not behaving normally when you go out to feed him. You notice an unusual nasal and eye discharge. He has been breathing very fast and has been eating less than half the amount you feed him. Then you realize he has been having diarrhea and has a cough that appears to be getting progressively worse. You decide to call the veterinarian as soon as you get back from the barn. The veterinarian comes the next day to examine your animal and diagnoses the steer with Bovine Respiratory Disease. You are given two treatment options to start that day (July 9). Treatment 1 is a broad-spectrum antibiotic that is given orally for 14 days. This treatment will cost \$14 and has a withdrawal period of 8 days. Treatment 2 is a narrow-spectrum antibiotic and is given by injections for 7 days. It will cost \$30 and has a longer withdrawal period: 28 days. (Please refer to Antibiotic Information Sheet.)

Sheep

A few weeks after docking your lambs' tails and castrating the males, you noticed an illness has fallen over your lambs. They became severely bloated, with a depressed appetite. They were very stiff in their movements; some were exhibiting muscle spasms. It was obvious that your lambs were sick and were extremely stressed. You made the quick decision to call your veterinarian. He diagnosed your lambs with tetanus. You were given two treatment options. Treatment 1 is a broad-spectrum antibiotic that is injected into the muscle every day for 4 days. Although this treatment costs only \$15, administering an intramuscular injection to your animal may be difficult and require an extra hand. This treatment has a withdrawal period of 8 days. Treatment 2 is a narrow-spectrum antibiotic that is injected only once, subcutaneously (under the skin). This treatment costs \$60 and has a withdrawal period of 21 days. You will begin treating the animal on July 3. (Please refer to Antibiotic Information Sheet.)

Swine

About 1 month after weaning your pigs, you noticed that all of them were weak. They were experiencing diarrhea and were extremely dehydrated. As they were walking around, they seemed uncoordinated, struggling to stand up. You called your veterinarian to come out and examine your pigs. She came to the conclusion that your swine have Swine Dysentery. You were given two treatment options. Treatment 1 is a broad-spectrum antibiotic that is given orally for 14 days. It will cost about \$12 and has no withdrawal period. Treatment 2 is a narrow-spectrum antibiotic, also given orally, and costing about \$15. The treatment period is 5 days and the withdrawal period is 7 days. You will choose a treatment and start it on July 1. (Please refer to Antibiotic Information Sheet.)

Dairy

Your cow has recently hit a peak in her lactation. Yesterday you started noticing that her udders were extremely inflamed and warm. In addition to being red, they seemed painful to the touch. Today when you went to milk her, the milk appeared off-white in color and watery. Something was not right, so you decided to ask your veterinarian to stop by. After a full examination, he informed you that your dairy cow has mastitis. He gave you two treatment options. Treatment 1 is a daily injection into the infected teat canals that continues for 8 days. This treatment has a withdrawal period of 9 days and will cost \$40. Treatment 2 costs \$20 and is a daily subcutaneous (under the skin) injection for 3 days and has a withdrawal period of 30 days. You will start a treatment on July 6. (Please refer to Antibiotic Information Sheet.)

JULY 2014

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

AUGUST 2014

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

PARASITE SCENARIOS

Market Beef Cattle: Coccidiosis

You are in a market cattle project and started to raise a 9-month-old steer. Now it is 20 months old at 1,100 pounds and ready to be shown. On July 13, you started to notice some differences in your steer. You noticed watery and bloody manure. Over the next couple of days you noticed your animal is losing weight and has a poor appetite and poor coordination. You checked your steer's weekly growth reports over the last month and were disappointed because it showed poor growth. Worried, you asked your veterinarian to come out to your farm on July 17. Your veterinarian examined your steer, did some tests, and concluded that your steer has Coccidiosis. In order to treat Coccidiosis and maintain the health of your steer so you will be able to show it, you have to take care of this problem. Your veterinarian gave you a list of treatment options for your steer. You narrow it down to option A and option B. You do some research online and find a natural remedy, option C, that can also be used to treat Coccidiosis in beef cattle. From these three possible treatment options, you must decide how you are going to treat your animal. Pick a treatment to start on July 17, describe why you chose that particular treatment and what effect, if any, it will have on how you show your market steer. Please refer to the Parasite Chart for help in making your decision.

Market Swine: Lungworm

You joined a pig project and started to raise a 4-month-old pig. Now it is 5 months old at 220 pounds and ready to be shown. On July 3, while your pig was resting, you noticed it periodically coughing. You didn't think much of it. Over the next couple of days, you noticed your pig was struggling to breathe and did not seem to want to eat. You checked her health records over the last few days and noticed a loss in weight. Worried, you took your pig to the veterinarian on July 14. Your veterinarian examined your pig, did some tests, and concluded that your swine has Lungworm. In order to treat Lungworm and maintain the health of your pig for show, you need to take care of this problem. Your veterinarian gave you a list of treatment options for your pig. You narrow it down to option A and option B. Then you do some research online and find a natural remedy, option C, that has been used on pigs. From these three possible treatment options, you must decide how you are going to treat your animal. Pick a treatment to start on July 14, describe why you chose that particular treatment, and what effect, if any, it will have on how you show your pig. Please refer to the Parasite Chart to help make your decision.

Market Beef Cattle: Lice

You are in a beef cattle project and started to raise a 6-month-old steer. Now it is 17 months old at 1,100 pounds and ready to be shown. On August 2, you start to notice your steer scratching more than usual. As the days pass, it seems like any opportunity your steer has to scratch, it will do so. It has gotten so bad that you notice remnants of blood on the objects it scratches against. One day you get an opportunity to get a close look at your steer. You are amazed to see the skin on its sides is completely raw.

Worried, you have your veterinarian come out to your farm on August 6. Your veterinarian examines your steer, does some tests, and concludes that your steer has lice. In order to treat lice and maintain the health of your steer for show, you have to take care of this problem. Your veterinarian gives you a list of treatment options for your steer. You narrow it down to option A and option B. You do some research online and find a natural remedy, option C, that can also be used to treat lice on beef cattle.

From these three possible treatment options, you must decide how you are going to treat your animal. Pick a treatment to start on August 6, describe why you chose that particular treatment, and what effect, if any, it will have on how you show your steer. Please refer to the Parasite Chart to help make your decision.

Market Swine: Mange Mites

You are in a pig club and started to raise a 2-month-old pig. Now it is 5 months old at 220 pounds and ready to be shown. On July 11, while your pig was resting next to a tree, you noticed it periodically getting up to scratch against the tree. You didn't think much of it. You were gone for a week on a school trip so you had your younger brother look after your pig. When you returned from your trip, you were shocked to see lesions over your pig's body. There were some areas that were much worse, with the hair missing and the skin cracked, raw, and bloody.

Worried, you took your pig to the veterinarian on July 21. Your veterinarian examined your pig, did some tests, and concluded that your pig has mange mites. In order to treat mange mites and maintain the health of your pig for show, you have to take care of the problem. Your veterinarian gave you a list of treatment options for your pig. You narrow it down to option A and option B. You do some research online and find a natural remedy, option C. From these three treatment options, you must decide how you are going to treat your animal. Pick a treatment to start on July 21, describe why you chose that particular treatment, and what effect, if any, it will have on how you show your pig. Please refer to the Parasite Chart to help make your decision.

PARASITE SCENARIOS, *continued*

Market Lamb: Haemonchus

You are in a market lamb club and started to raise a 3-month-old lamb. At 5 months old, your lamb weighs 145 pounds and is ready to be shown. On July 1, you noticed your lamb had very pale gums. Over the next few days, you noticed your lamb seemed weak and not motivated to move around. You also noticed some weight loss. Worried, you took your lamb to the veterinarian on July 5. Your veterinarian examined your lamb, did some tests, and concluded that your lamb has Haemonchus. In order to treat Haemonchus and maintain the health of your lamb for show, you have to take care of the problem. Your veterinarian gave you a list of treatment options for your lamb. You narrow it down to option A and option B. You do some research online and find a potential natural remedy, option C. From these three possible treatment options, you must decide how you are going to treat your animal. Pick a treatment to start on July 5, describe why you chose that particular treatment, and what effect, if any, it will have on how you show your lamb. Please refer to the Parasite Chart to help make your decision.

Dairy Cow: Flukes

You are in a dairy cow club and started to raise a 12-month-old dairy cow. Now it is 36 months old and ready to be shown. You have been busy with summer school so you haven't had much time to spend with your dairy cow. Luckily summer school was ending soon so you were going to have more time to spend and prepare your dairy cow for the show. On July 14 you finally got to spend quality time with your dairy cow. The first thing you noticed was she seemed to not want to eat very much. Within a few days you started noticing some weight loss and that she started having diarrhea. The diarrhea continued to persist and your cow started producing less milk.

Worried, you asked your veterinarian to come to your farm on July 15. Your veterinarian examined your dairy cow, did some tests, and concluded that your cow has flukes. In order to treat flukes and maintain the health of your dairy cow for the show, you have to take care of the problem. Your veterinarian gave you a list of treatment options for your dairy cow. You narrow it down to option A and option B. You research online and find that you can also use a natural remedy, option C. From these three possible treatment options, you must decide how you are going to treat your animal. Pick a treatment to start on July 15, describe why you chose that particular treatment, and what effect, if any, it will have on how you show your dairy cow. Please refer to the Parasite Chart to help make your decision.

Market Lamb: Lice

You are in a market lamb club and started to raise a 1-month-old lamb. Now it is 12 months old, weighs 145 pounds and is ready to be shown. On July 10, you started to notice it itching and scratching itself. Worried, you checked its coat but couldn't find the source of the itching. As the days progressed, the scratching got worse. It got to the point where your lamb seemed to pay more attention to scratching than eating. You noticed that it looked thinner and its coat looked dull with patches of coat loss.

Worried, you took your lamb to the veterinarian on July 14. Your veterinarian examined your lamb, did some tests, and concluded that your lamb has lice. In order to treat lice and maintain the health of your lamb for show, you have to take care of the problem. Your veterinarian gave you a list of treatment options for your lamb. You narrow it down to option A and option B. Being tight on money, you do some research online to find a potential natural remedy, option C. From these three possible treatment options, you must decide how you are going to treat your animal. Pick a treatment to start on July 14, describe why you chose that particular treatment, and what effect, if any, it will have on how you show your market lamb. Please refer to the Parasite Chart to help make your decision.

PARASITE CHART

Affected animals	Parasite	Symptoms	Treatment option	Treatment period	Withdrawal period	Type*	Regimen	Contraindications/restrictions	Cost†
Beef	Lice	<ul style="list-style-type: none"> Scratching Raw/bleeding skin due to excessive scratching Fatigue Anemia 	<i>Option A</i>	2 treatments over the course of 16 days	0 days	Off label	• Spray onto entire body once per treatment day.	None	\$
			<i>Option B</i>	1 day	3 days	FDA approved	• Spray onto entire body once a day.	Do not treat sick or stressed animals.	\$\$
			<i>Option C</i>	7 days	0 days	Natural remedy	• Rub a thin layer on entire body once a day.	None	\$
Beef	Coccidiosis	<ul style="list-style-type: none"> Bloody diarrhea Dehydration Weight loss Loss of appetite Loss of muscular coordination Loss of balance Seizures Poor growth 	<i>Option A</i>	4 days	10 days	FDA & EPA approved	• Give 1 tablet orally once a day.	Do not use on lactating animals.	\$\$\$
			<i>Option B</i>	21 days	0 days	FDA approved	• Give with water once a day.	None	\$\$
			<i>Option C</i>	10 days	0 days	Natural remedy	• Give orally twice a day.	Do not give to animals receiving other antibiotics. Allergic symptoms may occur, so discontinue use if symptoms are present.	\$\$
Swine	Mange mites	<ul style="list-style-type: none"> Itching Lesions on affected areas Raw/bleeding skin due to excessive scratching Hair loss 	<i>Option A</i>	2 treatments over the course of 6 days	18 days	Off label	• Single subcutaneous injection	None	\$\$
			<i>Option B</i>	2 treatments over the course of 2 days	24 days	FDA approved	• Single intramuscular injection	None	\$\$\$
			<i>Option C</i>	14 days	0 days	Natural remedy	• Apply on entire body 2 to 3 times a day.	None	\$
Swine	Lungworm	<ul style="list-style-type: none"> Coughing Labored breathing Loss of appetite Pneumonia 	<i>Option A</i>	3 days	0 days	Off label	• Administer in feed once a day.	Should not be used in animals with known hypersensitivity or allergy to the drug.	\$\$
			<i>Option B</i>	8 days	9 days	FDA approved	• Administer orally once a day.	None	\$
			<i>Option C</i>	9 days	0 days	Natural remedy	• Administer orally twice a day.	None	\$\$\$

Affected animals	Parasite	Symptoms	Treatment option	Treatment period	Withdrawal period	Type*	Regimen	Contraindications/restrictions	Cost†
Sheep	Lice	<ul style="list-style-type: none"> • Itching • Lesions on affected areas • Raw/bleeding skin due to excessive scratching • Weight loss 	<i>Option A</i>	2 treatments over the course of 5 days	0 days	FDA & EPA approved	• Dust evenly over entire body once per treatment day.	None	\$
			<i>Option B</i>	1 day	14 days	FDA approved	• Spray once on entire body.	None	\$\$\$
			<i>Option C</i>	1 day	0 days	Natural remedy	• Saturate entire wool once with water.	Kills only active adult lice.	\$
Sheep	Haemonchus	<ul style="list-style-type: none"> • Loss of large quantities of blood and proteins • Weakness • Anemia • Pale gums • Pale lining of the eyelids • Weight loss • Brittle wool • Wool loss • Diarrhea 	<i>Option A</i>	14 days	10 days	Off label	• Administer in feed once a day.	None	\$
			<i>Option B</i>	6 days	30 days	FDA approved	• Administer drench twice a day for 16 days.	Treat at 2-week intervals. High doses can cause toxemia in ewes. Safe for use during pregnancy.	\$\$\$
			<i>Option C</i>	5 days	17 days	Natural remedy	• Give orally once a day.	Do not dose lactating animals whose milk or milk products are intended for human consumption.	\$
Dairy cows	Flukes	<ul style="list-style-type: none"> • Loss in body condition • Decreased milk yield • Decreased fertility • Diarrhea • Decreased appetite • Decreased weight gain • Impaired ability for body to convert feed into body mass 	<i>Option A</i>	1 day	35 days	FDA approved	• One subcutaneous injection	None	\$\$\$
			<i>Option B</i>	10 days	28 days	FDA approved	• Give orally once a day.	None	\$
			<i>Option C</i>	21 days	0 days	Natural remedy	• Give orally once a day, through dropper or in a controlled drinking source.	None	\$\$

† Cost: \$ = Not expensive; \$\$ = Moderately expensive; \$\$\$ = Very expensive

* Type: FDA approved = Safe and effective treatment according to the US Food and Drug Administration (FDA), when used as directed by the label;
 EPA approved = Approved within the standards and regulations of the US Environmental Protection Agency (EPA);
 Off label = A drug that is used otherwise than as directed by the FDA-approved label;
 Natural remedy = An approach to treatment of a disease or illness that does not involve the use of a drug.

REFERENCES

Beef Cattle

- BioLegend. n.d. Monensin Solution (1000X). www.biolegend.com/monensin-solution-1000x-1500.html
- ECO Animal Health. n.d. ECOX 200. www.ecoanimal-health.com/_assets/documents/29.pdf
- Farquhar, N. 2002. Cattle lice. Petalia: A World of Petcare. The State of Victoria, Department of Primary Industries. www.petalia.com.au/Templates/StoryTemplate_Process.cfm?Story_No=1823&specie=8
- Jeffers Livestock. n.d. www.jefferspet.com/jeffers-live-stock/camid/LIV/ca/135/
- Kvasnicka, B. n.d. Coccidiosis in Beef Cattle. Beef Cattle Handbook. www.iowabeefcenter.org/Beef%20Cattle%20Handbook/Coccidiosis.pdf
- Merck Veterinary Manual. n.d. Coccidiosis of Cattle. Merck Sharp & Dohme Corp. www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/21202.htm
- Mississippi State University Extension Service. 2010. Insect pests of beef cattle: Cattle lice. <http://msucares.com/insects/beef/lice.html>
- National Sustainable Agriculture Information Service. 2008. Question of the Week: What Can You Tell Me About Organic Parasite Control in Cattle?. National Center for Appropriate Technology. <http://attra.ncat.org/calendar/question.php/2008/02/25/p5024>
- PBS Animal Health. n.d. Prolate/Lintox-HD. [www.pbsanimalhealth.com/details/Prolate-Lintox-HD/145-550.html](http://pbsanimalhealth.com/details/Prolate-Lintox-HD/145-550.html)
- Starbar Products. 2009. Prolate/Lintox-HD (Label). Wellmark International. www.starbarproducts.com/MSDS_new/ProlateLintox_splb.pdf
- US Environmental Protection Agency. 2006. Permethrin Facts. www.epa.gov/oppsrrd1/REDS/factsheets/permethrin_fs.htm

Chickens

- Barry, J. 2002. External Parasites of Poultry. The Poultry Site. www.thepoultrysite.com/articles/14/external-parasites-of-poultry
- Beyer, R. S. 1999. Eliminating Mites in Poultry Flocks. Kansas State University. www.ksre.ksu.edu/bookstore/pubs/MF2387.pdf
- Butcher, G. D., and M. A. Davis. 2014. Intestinal and Tracheal Parasites of Poultry. University of Florida IFAS Extension. <http://edis.ifas.ufl.edu/aa078>
- Butcher, G. D., and R. D. Miles. n.d. Intestinal Parasites in Backyard Chicken Flocks. University of Florida IFAS Extension. <http://edis.ifas.ufl.edu/vm015>
- Chicken Keeping Secrets. n.d. www.chickenkeepingsecrets.com/members/archives/145
- Clauer, P. J. 2009. Avian Disease Fact Sheet. Virginia Cooperative Extension. <http://pubs.ext.vt.edu/2902/2902-1094/2902-1094.html>
- Durvet. n.d. www.durvet.com/prods/RABON_643/DetailSheet.html
- Kaufman, P.E. 2013. External Parasites of Poultry. University of Florida IFAS Extension. <http://edis.ifas.ufl.edu/ig140>
- Kegley, S. E., B. R. Hill, S. Orme, and A. H. Shoi. 2010. PAN Pesticides Database-Pesticide

Products. Pesticide Action Network. www.pesticideinfo.org/Detail_Product.jsp?REG_NR=00234200831&DIST_NR=002342

- McCrea, B., J. S. Jeffrey, R. A. Ernst, and A. C. Gerry. 2005. Common Lice and Mites of Poultry: Identification and Treatment. University of California Agriculture and Natural Resources. <http://anrcatalog.ucdavis.edu/pdf/8162.pdf>
- MSU Coordinated Access to the Research and Extension System. 2009. External Parasites of Poultry. Mississippi State University Extension Service. <http://msucares.com/pubs/infosheets/is0331.htm>
- Savage, T. 2008. Internal Parasites. University of New Hampshire Cooperative Extension & University of Connecticut Cooperative Extension. http://extension.unh.edu/resources/files/Resource000811_Rep844.pdf

Dairy Cattle

- Chemist Direct. n.d. www.chemistdirect.co.uk/fasinex-cattle-10_1_19036.html
- Fane Valley Stores. n.d. Closamectin Injection for Cattle 500 mL. www.fanevalleystores.com/product/102223/closamectin-injection-for-cattle-500ml
- FDA Center for Veterinary Medicine. n.d. Bo-Ana Famphur Cattle Insecticide Warbex Famphur Cattle Pour-On. US Department of Health & Human Services. www.accessdata.fda.gov/scripts/AnimalDrugsAtFDA/details.cfm?dn=034-697
- Interchemie. n.d. Tribenol-50 Oral. www.interchemie.com/veterinary-products/cattle-cows/tribenol-50-oral.html

- Jeffers Equine. n.d. www.jefferspet.com/jeffers-equine/camid/EQU/ca/134/
- Kaufman, P. E., P. G. Koehler, and J. F. Butler. n.d. External Parasites of Dairy Cattle. University of Florida IFAS Extension. <http://edis.ifas.ufl.edu/IG050>
- Merial. n.d. IVOMEC EPRINEX Pour-On for Beef and Dairy Cattle. us.merial.com/producers/products/cowcalf_ivomec_eprinex.asp
- National Office of Animal Health. n.d. Fasinex 10% Oral Suspension for Cattle. www.noah-compendium.co.uk/Novartis_Animal_Health_UK_Ltd/Fasinex_10_ACU_-_Oral_Suspension_for_Cattle/-28054.html
- Pedretti, J. n.d. Controlling External Parasites on the Organic Farm. Organic Valley. www.organicvalley.coop/pdf/pools/controlling_parasites.pdf
- Roberts, N., and S. Swainson. n.d. Liver Fluke in Cattle. Dalehead Vet Group. www.dalehead-vetgroup.co.uk/Factsheets/farm/Liver%20Fluke%20in%20cattle.pdf
- Sheep**
- Animal Medic Inc. n.d. www.animalmedic.com/category.asp?catid=7
- Hamby Dairy Supply. n.d. Rumatel Goat & Cattle Wormer. <http://hambydairysupply.com/xcart/product.php?productid=1320&cat=105&page=1>
- Kaufman, P. E., P. G. Koehler, and J. F. Butler. n.d. External Parasites of Sheep and Goats. University of Florida IFAS Extension. <http://edis.ifas.ufl.edu/IG129>
- Kegler, S. E., B. R. Hill, S. Orme, and A. H. Choi. 2010. Y-TEX Python Dust Livestock Insecticide. PAN Pesticide Database. www.pesticideinfo.org/Detail_Product.jsp?REG_NR=03903900009&DIST_NR=039039
- MSD Animal Health. n.d. Product Details-NASALCUR. Intervet International B.V. www.msd-animal-health.co.za/products/nasalcur/020_product_details.aspx
- National Pesticide Information Center. 2012. Neem Oil General Fact Sheet. Oregon State University. <http://npic.orst.edu/factsheets/neem-gen.html>
- Neemaura Naturals. n.d. Organic Neem Seed Oil. www.iherb.com/productdetails.aspx?pid=14147&utm_source=g&utm_medium=x
- Rook, J. S. n.d. Available Sheep Anthelmintics (Dewormers). Michigan State University College of Veterinary Medicine. <http://old.cvm.msu.edu/extension/Rook/ROOKpdf/deworm.PDF>
- Townsend, L. 2014. Ent-22 Insect Control on Sheep and Goats. University of Kentucky College of Agriculture, Food and Environment. <http://pest.ca.uky.edu/EXT/Recs/ENT22-Sheepgoats.pdf>
- Townsend, L. n.d. Sheep Pests. University of Kentucky College of Agriculture, Food and Environment. www.ca.uky.edu/entomology/entfacts/ef503.asp
- United States Environmental Protection Agency. 2013. Atroban 11% EC Amended Reregistration Label. www.epa.gov/pesticides/chem_search/ppls/000773-00059-20130826.pdf
- United States Environmental Protection Agency. 2011. Y-TEX Python Dust Amended Reregistration Label. www.epa.gov/pesticides/chem_search/ppls/039039-00009-20110802.pdf
- Whittier, W. D., A. Zajac, and S. H. Umberger. 2009. Control of Internal Parasites in Sheep. Virginia Cooperative Extension. www.ext.vt.edu/pubs/sheep/410-027/410-027.html
- Vet Products Online. n.d. www.vetproductsonline.co.za/products/sheep-goats
- Swine**
- Averbeck, G. A., and B. E. Stromberg. n.d. Sarcopic Mange in Swine. Swine Health and Production. 1(5). www.aasv.org/shap/issues/v1n5/v1n5p28.pdf
- Cambell, J. B., and B. Straw. 1992. Controlling External Swine Parasites. University of Nebraska-Lincoln. <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=2148&context=extensionhist>

Dickinson Research Extension Center. n.d. Some Diseases and Parasites of Swine. North Dakota State University. www.ag.ndsu.edu/archive/dickinso/research/1975/some75.htm

Farmstead Health Supply. n.d. www.farmsteadhealth.com/restoresustain.html

FDA Animal & Veterinary. 2012. NADA 128-409 Ivomec Injection for Cattle and Swine. US Department of Health & Human Services. www.fda.gov/AnimalVeterinary/Products/ApprovedAnimalDrugProducts/FOIADrugSummaries/ucm074175.htm

FDA Animal & Veterinary. 2012. NADA 141-061 Dectomax Injectable Solution. US Department of Health & Human Services. www.fda.gov/AnimalVeterinary/Products/ApprovedAnimalDrugProducts/FOIADrugSummaries/ucm116688.htm

FDA Center for Veterinary Medicine. n.d. Dectomax Injectable Solution for Cattle and Swine. US Department of Health & Human Services. www.accessdata.fda.gov/scripts/AnimalDrugsAtFDA/details.cfm?dn=141-061

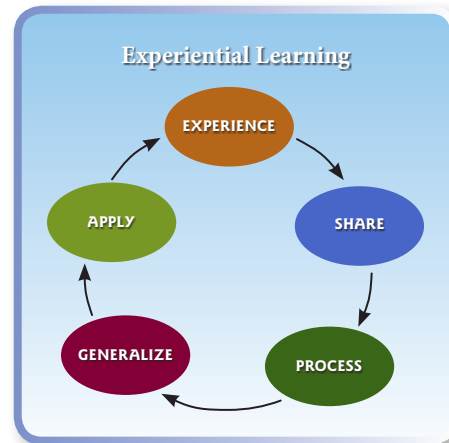
Jeffers Livestock. n.d. www.jefferslivestock.com/ssc/product.asp?CID=2&pf_id=16376

Lee, A. 2012. External Parasites of Pigs. NSW Government: Department of Primary Industries. www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/433084/External-parasites-of-pigs.pdf

Lee, A. 2012. Internal Parasites of Pigs. NSW Government: Department of Primary Industries. www.dpi.nsw.gov.au/__data/assets/pdf_file/0019/433018/internal-parasites-of-pigs.pdf

APPENDIX

The activities in this curriculum were designed around inquiry and experiential learning. Inquiry is a learner-centered approach in which individuals are problem solvers investigating questions through active engagement, observing and manipulating objects and phenomena, and acquiring or discovering knowledge. Experiential learning (EL) is a foundational educational strategy used in 4-H. In it, the learner has an experience phase of engagement in an activity, a reflection phase in which observations and reactions are shared and discussed, and an application phase in which new knowledge and skills are applied to a real-life setting. In 4-H, an EL model that uses a five-step learning cycle is most commonly used. These five steps—Experiencing, Sharing, Processing, Generalizing, and Application—are part of a recurring process that helps build learner understanding over time.



For more information on inquiry, EL, and the five-step learning cycle, please visit the University of California Science, Technology, and Environmental Literacy Workgroup's Experiential Learning website, www.experientiallearning.ucdavis.edu/default.shtml.

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