



SCRUB:

Science Creates Real Understanding of Biosecurity

Curriculum Instructor Guide

SCRUB Curriculum and Kit Development Team



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Acknowledgments



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SCRUB:

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Instructor Guide

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Introduction

SCRUB: Science Creates Real Understanding of Biosecurity

This SCRUB curriculum and the corresponding SCRUB kit were developed through a collaboration between Dr. Betsy Greene, University of Arizona, and Dr. Kris Hiney, Oklahoma State University. The SCRUB curriculum activities complement the [Biosecurity Learning Modules](#) developed by the Animal Disease Biosecurity Coordinated Agricultural Project (ADBCAP) education team and posted on the [Healthy Farms Healthy Agriculture](#) website.

The SCRUB curriculum and the corresponding SCRUB kit link hands-on activities with science, technology, engineering and math (STEM) education, by incorporating science into fun activities to engage youth in grades 6 - 12 with an existing interest in animal science. SCRUB fills an important need to teach youth about biosecurity since their animals may be at risk every time they travel to new places and mingle with other animals during shows and exhibitions.

The SCRUB curriculum has been built to provide all of the information needed for instructors (with or without biosecurity and animal knowledge) to conduct the lessons. Additionally, we included "At A Glance" sections at the beginning to show key points of the activities as well as what is needed for each lesson. There are shopping lists for each of the hands on activities, as well as information on purchasing the SCRUB kit. The SCRUB kit provides the majority of the items needed, with a few exceptions (e.g. frozen water bottles for cooler activity), to conduct the activity with a classroom or club group of up to 25 people.

Tips and Facts about this Curriculum:

- This material has been tested and used effectively with youth and adults.
- Several lessons can be adapted for teaching younger children.
- Many of the modules have activities that can be adapted for use in the classroom or broadened to actual farm/fair facilities.
- The SCRUB activities were designed to use inexpensive and easy to find materials to keep costs down for educators.
- The SCRUB kit has many reusable items and a shopping list for restocking the kit for future use.
- Each module can be adapted for the "species of interest" for the lessons.
- The appendix contains several ready to use examples for several of the activities.
- After each module the student guides are available in summary form as well as "easy to print" versions to hand out to the students.
- The online learning modules that complement SCRUB are available at: <https://go.uvm.edu/biosecurity-modules>
- Healthy Farms Healthy Agriculture link: <https://www.healthyagriculture.org/>

Please share any feedback, successes, or suggested changes with Dr. Betsy Greene at betsygreene@arizona.edu.

To learn more about ordering a SCRUB kit contact:

Dr. Betsy Greene at betsygreene@arizona.edu or Debbie Reed at dlreed@arizona.edu

Instructor Notes:

SCRUB Activity Shopping List and SCRUB Kit Contents

This information sheet provides a list of what items are needed for each activity as well as what is included in the SCRUB Kit and a guideline for any additional materials needed for each of the SCRUB curriculum modules and activities. In some cases, materials can be used for multiple activities and numbers of items depend upon expected group size and overall numbers of participants. Kit contains materials for a class of 25 students.

Notes

For vaccine cooler and agar plate incubator activities, if handled properly, the cooler and incubator can utilize the same materials. It is highly recommended that the cooler activity be done first, even though it is in a later module, to prevent the possibility of contaminants from the incubator activity.

Module I - Proper Cleaning and Disinfecting

Activity A: Handwashing

Items to Purchase or Included in Kit

- 1 bottle of Glo Germ™ lotion or gel
- 2 UV light

Additional Items Needed

- Access to a sink
- Access to a darkened area (to see UV light)

Activity B: Facility Challenge

Teacher

Items to Purchase or Included in Kit

- Powder Glo-Germ™
- 3 Popsicle sticks (to mix soil and glo-germ powder)
- 2 spoons
- Potting soil
- 1 bowl to mix soil
- Paper towels
- 2 UV lights (from Module 1-Activity A: Handwashing)

Additional Items Needed

- Water

Students (divide between 5 groups)

Items to Purchase or Included in Kit

- 5 small bar/chunk of Soap
- 5 plastic backed tablecloths
- 25 disposable bowls (cleaning vessels)
- 5 foam pieces (e.g. playroom flooring) simulating rubber mat flooring
- 5 flexible plastic cutting board mat simulating glass or plexiglass windows
- 5 treated wood pieces simulating walls/fencing
- 5 tile pieces simulating flooring in human areas of barn

- 5 Large scrub brushes
- 10 small scrub brushes (fingernail brushes)

Additional Items Needed (for each group)

- 1 gallon of water (helps them think critically and plan their methods when resource is limited)

Activity C: Cleaning and Disinfecting

Teacher

Items to Purchase or Included in Kit

- 30 sterile petri dishes
- 1 jar with premeasured agar powder
- Gloves
- Sharpie (for labeling petri dishes)

Students (divide between 5 groups)

Items to Purchase or Included in Kit – some materials will need to be reused from cooler building lab

- 5 boxes (12"x12" to serve as incubator/cooler)
- 2 rolls Duct tape (to seal box and secure bulb and thermometer)
- 30 Styrofoam pieces (serve as insulating walls in box)
- 5 indoor/outdoor thermometers
- 20 AAA batteries (for thermometer)
- 5 socket/plug for light bulb
- 5 extension cord
- 5 light bulbs
- 20 swabs (to collect and plate boot bottom or other item samples)
- 20 agar plates
- 1 bottle disinfectant
- 1 garbage bag – to dispose of used agar plates

Additional Items Needed (for each group)

- 4 "dirty" items to disinfect (e.g. boots/shoes/cleaning tools/etc.)

Module 2 - Direct and Indirect Disease Transfer

Activity A: Disease Transfer Lab

Teacher

Items to Purchase or Included in Kit

- 2 stirrers/popsicle sticks for preparation
- Povidone/Iodine solution (generic Betadine)
- 1 plastic spoon
- Cornstarch
- Powered Milk

Additional Items Needed

- Water

Students

Items to Purchase or Included in Kit

- 25 small cups (5 oz) (1 per student)
- 25 stirrer/popsicle sticks (1 per student)
- 2 marked dixie cups for measuring water

Additional Items Needed

- Water

Module 3 - Vaccines and Proper Handling

Activity A: Importance of Vaccines and Proper Handling

Additional Items Needed

- Provided supplemental materials and/or internet access

Activity B: Cooler Building Lab

Items to Purchase or Included in Kit (divide between 5 groups)

- some materials will be reused in incubator building activity

- 5 boxes (@12"x12"x12")
- 2 rolls Duct Tape
- 30 Styrofoam pieces
- 10 additional cardboard pieces
- 5 indoor/outdoor thermometers
- 20 AAA batteries (for thermometer)

Additional Items Needed

- 6 to 10 - 16.9 oz **frozen** water bottles per group (put in freezer at least 24 hours ahead to be completely frozen)
- "Vaccine" – the internal thermometer or test strip will be placed where a fake vaccine would be; instructors can use a vial/syringe etc. as the vaccine.

Activity C: Design a Vaccination Protocol (Optional)

Additional Items Needed

- Internet access

Module 4 - Building a Biosecure Barn or Facility

Activity A: Contamination from Another Angle

Additional Items Needed

- Internet access for youth/students
- A list of 5 to 10 different disease agents for youth to research transmission mechanisms (you can use Appendix A).
- AND/OR Local experts (veterinarians, public health officials, etc.) join the class for a discussion.

Activity B: Evaluating the Biosecurity of Facilities

Additional Items Needed

- Facility printouts from binder/online resource

For hands-on application

- Glue or tape
- Scissors
- Colored pencils/crayons/markers/expo markers
- Butcher paper (cut to 11"x17" for each facility) or white board

For computer generated application

- Use desired programs (e.g. Prezi, Powerpoint, etc.)
- Internet access

A Quick Glance at Activities

Module I - Cleaning and Disinfecting Activities

Activity A: Effective Hand Washing

Activity Objective

Participants will experience and evaluate their hand washing effectiveness and compare and understand methods of hand washing practices with World Health Organization (WHO) guidelines.

Total Time	Preparation: 5 minutes	Difficulty Level	Suggested Group Size
Approximately 30 minutes	Active: 25 minutes Wait: 0 minutes	Easy	Class

Materials

Items to Purchase or Included in Kit

- 1 bottle of Glo Germ™ lotion or gel
- 2 UV light

Additional Items Needed

- Access to a sink
- Access to a darkened area (to see UV light)

Activity B: Facility Sanitation Challenges

Activity Objective

Through this activity, participants will compare the ease (or not) and completeness of removal of contamination from various materials. Participants will relate their findings to the sanitation of various surfaces in facilities holding animals from multiple farms.

Total Time	Preparation: 20 minutes	Difficulty Level	Suggested Group Size
Approximately 40 minutes	Active: 20 minutes Wait: 0 minutes	Intermediate	Five per group

Materials

Teacher

Items to Purchase or Included in Kit

- Powder Glo-Germ™
- 3 Popsicle sticks (to mix soil and glo-germ powder)
- 2 spoons
- Potting soil
- 1 bowl to mix soil
- Paper towels
- 2 UV lights (from Module 1-Activity A: Handwashing)

Additional Items Needed

- Water

Students (divide between 5 groups)

Items to Purchase or Included in Kit

- 5 small bar/chunk of Soap
- 5 plastic backed tablecloths
- 25 disposable bowls (cleaning vessels)
- 5 foam pieces (e.g. playroom flooring) simulating rubber mat flooring
- 5 flexible plastic cutting board mat simulating glass
- 5 treated wood pieces simulating walls/fencing
- 5 tile pieces simulating flooring in human areas
- 5 Large scrub brushes
- 10 small scrub brushes (fingernail brushes)

Additional Items Needed (for each group)

- 1 gallon of water (helps them think critically and plan their methods when resource is limited)

Activity C: Cleaning and Disinfecting

Activity Objective

Through this activity, participants will learn and apply the principles of building an incubator and use that to test the outcome of various combinations of cleaning and disinfecting "dirty" items, using proper and improper techniques. Participants will determine the best protocol based on microbial growth on agar plates.

Total Time	Preparation: 20 minutes + 24 hour wait	Difficulty Level	Suggested Group Size
Approximately 55 minutes + a 5-day, 1.5 hour wait	Active: 35 minutes + 90 minute wait Wait: 4 days for bacterial growth	Intermediate	Five per group Total of five groups

Materials

Teacher

Items to Purchase or Included in Kit

- 30 sterile petri dishes
- 1 jar with premeasured agar powder
- Gloves
- Sharpie (for labeling petri dishes)

- 20 swabs (to collect and plate boot bottom or other item samples)
- 20 agar plates
- 1 bottle disinfectant
- 1 garbage bag – to dispose of used agar plates

Additional Items Needed (for each group)

- 4 "dirty" items to disinfect (e.g. boots/shoes/cleaning tools/etc.)

Students (divide between 5 groups)

Items to Purchase or Included in Kit – some materials will need to be reused from cooler building lab

- 5 boxes (12"x12" to serve as incubator/cooler)
- 2 rolls Duct tape (to seal box and secure bulb and thermometer)
- 30 Styrofoam pieces (serve as insulating walls in box)
- 5 indoor/outdoor thermometers
- 20 AAA batteries (for thermometer)
- 5 socket/plug for light bulb
- 5 extension cord
- 5 light bulbs

Notes

- If your classroom/facilities already have an incubator (for animal reproduction, hatching eggs, or growing bacteria), you can use that instead of making the incubator.
- This activity is relatively easy to implement, but additional time for constructing the incubator will need to be planned.
- Instructor should allow 2 to 24 hours prior to lab activity for plate preparation.
- Materials from building the incubator (boxes and styrofoam) are used in both this activity and Module 3 - Vaccines and Proper Handling Activity B - Cooler Building Lab. In order to use the materials for both activities **Module 3 - Activity B should be done first** to prevent contamination from the agar plates.

A Quick Glance at Activities

Module 2 - Direct and Indirect Disease Transfer

Activity A: Disease Transfer Lab

Activity Objective

To help students understand the ease of which an infected animal (with no visible signs) can transfer diseases to other animals with minimal contact or effort. In this case, the students can “become” the animals mingling together and unknowingly sharing “disease” with their peers. After they (their cups) get tested, then they can learn how to trace back to identify the original diseased animals based on common contacts.

Total Time	Preparation: 30 minutes	Difficulty Level	Suggested Group Size
Approximately 45 minutes	Active: 15 minutes Wait: 0 minutes	Easy	Class

Materials

Teacher

Items to Purchase or Included in Kit

- 2 stirrers/popsicle sticks and 1 spoon for preparation
- Povidone/Iodine solution (generic Betadine)
- Cornstarch
- Powered Milk

Additional Items Needed

- Water

Students

Items to Purchase or Included in Kit

- 25 small cups (5 oz) (1 per student)
- 25 stirrer/popsicle sticks (1 per student)
- 2 marked dixie cups for measuring water

Additional Items Needed

- Water
-

A Quick Glance at Activities

Module 3 - Vaccines and Proper Handling

Activity A: Importance of Vaccines and Proper Handling

Activity Objective

1. Identify which animal diseases of importance have vaccines and which do not.
2. Identify what types of vaccines are available.
3. Understand how handling affects vaccines effectiveness.

Total Time Approximately 30 minutes	Preparation: 0 minutes Active: 30 minutes Wait: 0 minutes	Difficulty Level Easy	Suggested Group Size Individual, Small Group, or Class
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Materials

- Provided supplemental materials and/or internet access.
-

Activity B: Cooler Building Lab

Activity Objective

1. Understand how handling affects vaccines effectiveness.
2. Be able to create appropriate coolers suitable for housing vaccines out of common household materials.

Total Time Approximately 25 hours, 40 minutes	Preparation: 15 minutes Active: 25 minutes Wait: 25 hours	Difficulty Level Intermediate	Suggested Group Size Five per group Total of five groups
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Materials

Items to Purchase or Included in Kit (divide between 5 groups)

- some materials will be reused in incubator building activity

- 5 boxes (@12"x12"x12")
- 2 rolls Duct Tape
- 30 Styrofoam pieces
- 10 additional cardboard pieces
- 5 indoor/outdoor thermometers
- 20 AAA batteries (for thermometer)

Additional Items Needed

- 6 to 10 - 16.9 oz **frozen** water bottles per group (put in freezer at least 24 hours ahead to be completely frozen)
 - "Vaccine" – the internal thermometer or test strip will be placed where a fake vaccine would be; instructors can use a vial/syringe etc. as the vaccine.
-

Activity C: Design a Vaccination Protocol (optional)

Activity Objective

1. Identify animal diseases of importance to your species or geographic location.
2. Identify what types of vaccines are available for those diseases.
3. Create a vaccination plan for their species of interest.

Total Time 30 to 45 minutes	Preparation: 0 minutes Active: 30 to 45 minutes Wait: 0 minutes	Difficulty Level Intermediate	Suggested Group Size Small Group
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Materials

- Internet access.
-

A Quick Glance at Activities

Module 4 - Building a Biosecure Barn or Facility

Activity A: Contamination from Another Angle

Activity Objective

Students will be able to identify different types of contaminants and methods of transmission between animals (and/or humans).

Total Time	Preparation: 30 minutes if scheduling guest speakers. Active: 15 minutes Wait: 0 minutes	Difficulty Level	Suggested Group Size
Approximately 45 minutes to 1.5 hours		Easy	Class (or small groups)

Materials

Items to purchase or provide

- Internet access for youth/students
- A list of 5 to 10 different disease agents for youth to research transmission mechanisms (you can use Appendix A).
- AND/OR Local experts (veterinarians, public health officials, etc.) join the class for a discussion.

Activity B: Evaluating the Biosecurity of Facilities

Activity Objective

Students will be able to identify areas of concern for disease transmission in small or large facilities by analyzing building locations, traffic patterns, animal shared spaces, availability of quarantine space, locations of, and access to, feed, water, hay, shavings, bedding, and manure storage, etc.

Total Time	Preparation: 30 minutes Active: 60+ minutes Wait: 0 minutes	Difficulty Level	Suggested Group Size
Approximately 90 minutes Could be a multi-day project depending on level of difficulty and engagement.		Medium to advanced	Class, small groups, or individual

Materials

Items to purchase or provide

- Facility printouts from binder/online resource

For hands-on application

- Glue or tape
- Scissors
- Colored pencils/crayons/markers/expo markers
- Butcher paper (cut to 11"x17" for each facility) or white board

For computer generated application

- Use desired programs (e.g. Prezi, Powerpoint, etc.)
- Internet access



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SCRUB: Science Creates Real Understanding of Biosecurity Instructor Guide

Module I

Cleaning and Disinfecting Activities

Authors: Kris Hiney, Betsy Greene, and Brittani Kirkland

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Acknowledgments



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Introduction

Proper hygiene and sanitation are keys to reducing the spread of animal diseases and human diseases as well. Proper sanitation involves not only washing to remove the visible dirt but also proper use of both detergents and disinfectants. The facilities which house animals and the materials of which they are constructed may make these tasks more difficult.

In this activity, students will explore their ability to scrub away the hidden germs on themselves, their footwear, and materials that are commonly used to build animal enclosures.

Key Concepts

- What is a fomite?
- How are animal diseases typically spread?

Goals & Learning Objectives

At the end of this activity, participants should be ready to do the following:

1. Explain what "animal biosecurity" is to friends or family members.
2. Emphasize the importance of proper cleaning techniques to limit disease spread.
3. Differentiate between surfaces/objects in animal environments which can harbor disease most easily and compare their ease in cleaning.
4. Identify the most effective cleaning and disinfecting methods used to limit disease spread.
5. Describe the most frequent cleaning/disinfecting mistakes which commonly occur, and the importance of following thorough cleaning and disinfectant instructions and protocols to eliminate pathogens.

Setting the Scene

Provide a real-world example of an animal disease (e.g., foot-and-mouth disease (FMD), vesicular stomatitis (VS), etc.) and how it is spread.

Choose diseases most likely to be of interest to the particular group. Include additional information you think would be helpful or educational to participants. You can also open it up for questions after the lecture. For example, if your students are more interested in cattle, choose a disease scenario based on a bovine disease. Consider inviting participants to research diseases in advance.

Other Options

The scenario can be set up in a variety of ways, depending on the age, knowledge level, background, and experience of your participants. For example, if you are working with 4-H Horse Project youth, "strangles" would be a potentially recognizable disease to choose. High school FFA senior students could have the activity involve research on their part to identify the disease based on "presenting" signs, and establish methods of transmission and procedures, practices, or changes in behavior on the farm/ranch to decrease transmission potential. A third option could involve a "CSI" or crime scene investigation set up where a veterinarian "needs help" determining how to advise their ranching clients to prevent an outbreak or broad spread of a specific disease.

Sample Disease Presentation

Choose diseases which may be of interest from the disease charts provided in Appendix A and stories of disease transmission in Appendix B. The following is an example using PEDv.

Porcine epidemic disease virus (PEDv)

June 2014

First identified in the United States in May 2013, the disease had spread to 30 states by June 2014. It is estimated that PEDv killed more than 10% of pigs born. In a study of an outbreak involving 222 swine units in 4 states, 40.5% of all units were found positive for PEDv. However, 80% of the sow units were found positive. The study also found geographic clustering of positive units, meaning units that were near units that had an incidence of PEDv were more likely to also acquire the disease.

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4692406/>

March 22, 2019

Several pigs at the Oklahoma Youth Expo (OYE) were diagnosed with PEDv as confirmed by OSU's Oklahoma Animal Disease Diagnostic Laboratory. Several pigs became ill and it is assumed most pigs at the show were exposed, including the pigs of the 2019 Night of Stars show and all of the pigs at the gilt and barrow shows. It has been recommended to take biosecurity measures to prevent the disease from spreading to farms when the pigs are brought home or sold.

- <https://www.nationalhogfarmer.com/livestock/oklahoma-youth-swine-show-breaks-ped-virus>
- https://news.okstate.edu/articles/agricultural-sciences-natural-resources/2019/stotts_pedv-at-oye.html

Activity A: Effective Hand Washing

Activity Objective

Participants will experience and evaluate their hand washing effectiveness and compare and understand methods of hand washing practices with World Health Organization (WHO) guidelines.

Total Time Approximately 30 minutes	Preparation: 5 minutes Active: 25 minutes Wait: 0 minutes	Difficulty Level Easy	Suggested Group Size Class
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Materials

Items to Purchase or Included in Kit

- 1 bottle of Glo Germ™ lotion or gel
- 2 UV light

Additional Items Needed

- Access to a sink
- Access to a darkened area (to see UV light)

Video Links

Effective Hand Washing Activity Overview Video for Instructors

- <https://youtu.be/w0DQosKdsR4>

How to hand wash? With soap and water

- <https://youtu.be/3PmVJQUCm4E>

Setup/Preparation – Approximately 5 minutes

1. Day Prior: Be sure to warn students to wear appropriate clothing (i.e., easily washable) due to the use of Glo Germ™. Gather materials.

Initial Engagement Questions

1. Do you think you wash your hands properly?
2. Can you guess what parts of your hands you may miss when you wash?
3. Do you think you contaminate any other surfaces when you wash your hands?
4. Does shaking hands have the potential to transmit disease? Why or why not?

Hand Washing Activity Introduction

Students will visualize the degree of contamination through physical contact as well as the need for thorough hand washing. This can be structured in multiple ways depending on class size and set-up.

Activity A Steps - approximately 20 minutes

1. Apply a pea size drop of Glo Germ™ oil to students' hands or have them shake hands/handle something with Glo Germ™ oil on it.
2. Send students to wash their hands. Ask them to wash them as they normally would.
3. Note: A classroom with sinks is ideal or access to restrooms is needed.
4. Note: They can dry their hands with driers, paper towels, or rags.
5. Examine students' hands with UV light in a darkened room/space to determine how effective they were at handwashing.
6. Now watch the WHO hand washing video (see link on page 7).
7. Have students re-wash their hands using the technique discussed in the video.
8. Check their hands again with the UV light.
9. Now examine all surfaces they may have encountered during the process (e.g., doorknobs and counter tops) with the UV light. See how "disease" contamination can easily be spread.

Instructor Notes

Warning for teachers: The more the students touch, the more you will have to clean at the end of the class period, and they may smear "disease" on each other. The Glo Germ™ oil is washable with an oil-based product. It is important to advise students in advance to wear washable clothing the day of this activity.

Instructor Options

In activity step 1, introduce a new person to have students shake hands with, then announce later they are sick. "Oh, by the way, so-and-so isn't feeling well and may have a cold."

Other options can include some variation of placing the "disease" (Glo Germ™) on door handles or other commonly handled/shared equipment. Then set up the scenario explaining that one person has informed you that they have a sick horse/sheep/cow at home. Engage the students in a discussion and have them help identify the disease with signs. Ask if they should be worried about their own animals and "expose" the contamination on fomites and their hands.

Discussion Questions

1. How effective was your initial hand washing? Where did "germs" still reside on your hands?
2. Did you contaminate any other surfaces?
3. How clean were your hands after following the procedure shown in the video?
4. What specifically did you do differently from the first time you washed your hands?
5. What could you do to limit disease spread through contact?
6. When working with animals, when would it be important to follow these hand washing recommendations?

Activity B: Facility Sanitation Challenge

Activity Objective

Through this activity, participants will compare the ease (or not) and completeness of removal of contamination from various materials. Participants will relate their findings to the sanitation of various surfaces in facilities holding animals from multiple farms.

Total Time Approximately 40 minutes	Preparation: 20 minutes Active: 20 minutes Wait: 0 minutes	Difficulty Level Intermediate	Suggested Group Size Five per group
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Materials

Teacher

Items to Purchase or Included in Kit

- Powder Glo-Germ™
- 3 Popsicle sticks (to mix soil and glo-germ powder)
- 2 spoons
- Potting soil
- 1 bowl to mix soil
- Paper towels
- 2 UV lights (from Module 1-Activity A: Handwashing)

Additional Items Needed

- Water

Students (divide between 5 groups)

Items to Purchase or Included in Kit

- 5 small bar/chunk of Soap
- 5 plastic backed tablecloths
- 25 disposable bowls (cleaning vessels)
- 5 foam pieces (e.g. playroom flooring) simulating rubber mat flooring
- 5 flexible plastic cutting board mat simulating glass
- 5 treated wood pieces simulating walls/fencing
- 5 tile pieces simulating flooring in human areas
- 5 Large scrub brushes
- 10 small scrub brushes (fingernail brushes)

Additional Items Needed (for each group)

- 1 gallon of water (helps them think critically and plan their methods when resource is limited)

Video Link

Facility Sanitation Challenges Activity Overview for Instructors

- <https://youtu.be/GSi7OzNHRy4>

Setup/Preparation – approximately 20 minutes (complete before students arrive)

1. Put ½-1 cup of potting soil in bowl and mix with 2 tablespoons of water. The consistency should be firm, but water should come out if squeezed. Add more water if needed.
1. Sprinkle ½-1 teaspoon of sifted Glo Germ™ powder onto the wet soil and mix. Use UV light to check media is thoroughly “contaminated” with the Glo Germ™ powder. Add more Glo Germ™ if needed.
2. This soil represents “manure” filled with Glo Germ™ representing the bacteria/virus.
3. Apply “manure” to each material (wood pieces, plastic, the back side of the tile, and rubber mat), so the manure covers about ¼ of the surface. Once applied, press down on the “infected soil” to ensure water runs out and spreads on the surface of the material. There should not be any large clumps of material only watery soil residue. These materials represent “barn” or “facility” surfaces that have been contaminated.
4. Allowing materials to dry should not affect the activity. However, conducting the activity while “manure” is still wet is recommended.

Initial Engagement Questions

1. What type of animal facilities/objects do you interact with which would need to be cleaned and disinfected?
2. What kind of facilities did you have at shows/auctions you've attended?
3. What materials were the stalls and animal holding facilities constructed of?
4. Have you ever cleaned a facility before use?
5. If you have animals, what materials were used to construct your housing systems/facilities?

Facility Sanitation Challenges Activity Introduction

In this activity you will work together in a team to achieve the objective of getting a clean barn!

NOTE: Decide ahead of time if you will run the activity with students competing as teams to get awarded a "sanitation contract" or competing as relay teams to fully clean their barns. (See instructor options below.)

Possible Examples

1. You have had an outbreak of _____ (instructor's choice from list provided in Appendix A) and now must thoroughly clean all surfaces before healthy animals can move back in.
2. A new horse arrives on the premises and within 24 hours develops a fever and snotty nose.
3. Create your own scenario using animal/disease of interest to students.

Activity B Steps - approximately 20 minutes

1. Divide students into groups of five. Each group has up to five different "facility" or "barn" materials with "manure" on them.
2. Each student should clean one surface until all surfaces have been cleaned.
3. Allow students to come up with their own strategies, including how to clean and in what order.
Or: Have a team of students work up a procedure to clean all the items without "re-contamination" of the items (e.g. order of brushes, clean/dirty hands/water/brushes, etc.).

Instructor Notes

Do not allow materials to be dried with paper towels. Paper towel lint can glow under UV light. Kimwipes™ do not. You wouldn't dry a barn, so air drying is recommended.

Instructor Options

1. Sanitation Contract
 - Students compete as teams to get awarded a "sanitation contract".
 - The team with the cleanest surfaces wins.
 - Measure "cleanness" with UV light at end or throughout (instructor's choice). Items are deemed clean when the UV light reveals no remaining Glo Germ™.

2. Relay Teams

- Students compete in relay teams to fully clean their barns.
- One surface must be “clean” before the next individual can start cleaning the next surface. Items are deemed clean when the UV light reveals no remaining Glo Germ™.
- The first team to completely clean their “barn” and have no evidence of germs/manure (Glo Germ™ powder) is the winner.

3. Teamwork Effort

- Each team plans a method to clean the assigned items given the tools that they have. All students must have an identified role in this process. Determine which team did the most thorough job on their items.

Discussion Questions

1. Was it better to clean materials quickly or thoroughly? What was the impact on the number of pathogens remaining?
2. What material was easiest to clean? Why?
3. Which materials would you recommend for use in your home facilities? Why?
4. What materials would you recommend for show facilities?
5. What would you do if your animal had to be housed in a facility with evidence of organic matter?

Activity C: Cleaning and Disinfecting

Activity Objective

Through this activity, participants will learn and apply the principles of building an incubator and use that to test the outcome of various combinations of cleaning and disinfecting “dirty” items, using proper and improper techniques. Participants will determine the best protocol based on microbial growth on agar plates.

Total Time	Preparation: 20 minutes + 24 hour wait	Difficulty Level	Suggested Group Size
Approximately 55 minutes + a 5-day, 1.5 hour wait	Active: 35 minutes + 90 minute wait Wait: 4 days for bacterial growth	Intermediate	Five per group Total of five groups

Materials

Teacher

Items to Purchase or Included in Kit

- 30 sterile petri dishes
- 1 jar with premeasured agar powder
- Gloves
- Sharpie (for labeling petri dishes)

Students (divide between 5 groups)

Items to Purchase or Included in Kit – some materials will need to be reused from cooler building lab

- 5 boxes (12"x12" to serve as incubator/cooler)
- 2 rolls Duct tape (to seal box and secure bulb and thermometer)
- 30 Styrofoam pieces (serve as insulating walls in box)

- 5 indoor/outdoor thermometers
- 20 AAA batteries (for thermometer)
- 5 socket/plug for light bulb
- 5 extension cord
- 5 light bulbs
- 20 swabs (to collect and plate boot bottom or other item samples)
- 20 agar plates
- 1 bottle disinfectant
- 1 garbage bag – to dispose of used agar plates

Additional Items Needed (for each group)

- 4 “dirty” items to disinfect (e.g. boots/shoes/cleaning tools/etc.)

Notes

- If your classroom/facilities already have an incubator (for animal reproduction, hatching eggs, or growing bacteria), you can use that instead of making the incubator.
- This activity is relatively easy to implement, but additional time for constructing the incubator will need to be planned.
- Instructor should allow 2 to 24 hours prior to lab activity for plate preparation.
- Materials from building the incubator (boxes and styrofoam) are used in both this activity and Module 3 - Vaccines and Proper Handling Activity B - Cooler Building Lab. In order to use the materials for both activities **Module 3 - Activity B should be done first** to prevent contamination from the agar plates.

Video and Website Links

Incubator Building Overview for Instructors

- <https://youtu.be/XNsPsQYrNBo>

Disinfecting Activity Overview for Instructors

- <https://youtu.be/KePZ5F6lEE>

Observing bacteria in a Petri dish (Microbiology Society)

- <https://microbiologysociety.org/why-microbiology-matters/what-is-microbiology/bacteria/observing-bacteria-in-a-petri-dish.html>

Setup/Preparation – approximately 20 minutes + 2 to 24 hour wait

Instructor

1. Either prepare agar plates according to manufacturer's directions or use the directions provided in Appendix C.
 - a. Allow 2 to 24 hours prior to lab activity for plate preparation.
 - b. Simple agar plates will grow the greatest range of bacteria.
2. Or purchase pre-made agar plates through Nasco, Amazon, a local veterinarian, etc.

Initial Engagement Questions

1. Is there a difference between cleaning and disinfecting an item or facility?
2. Do you think spraying disinfect on boots eliminates the need to clean them?
3. Can you spray disinfectant on your stall walls at a show when you arrive without cleaning them?
4. Do you have to follow instructions on disinfectants in order for them to be effective?

Cleaning and Disinfecting Activity Introduction

The importance of proper cleaning and following manufactures guidelines can be readily evaluated and visualized through the growth of bacteria on items improperly cleaned and/or disinfected. This activity has two sections, of which either or both can be planned and executed in one or more sessions. The first activity involves creating an incubator out of commonly available materials. The process will help participants understand the components and their contribution to the final product. Part 2 puts the incubator to use, while testing several different levels of cleaning and disinfecting fomites (often boots) that can carry disease causing bacteria found in the barn.

This activity brings to light the difficulty of cleaning and disinfecting surfaces properly. Rough boot treads can provide refuge for bacteria even with heavy scrubbing. By using common methods to clean, disinfect, or both; swabbing the surface, streaking the agar plate, and incubating the plates, participants can watch for bacterial growth. A properly cleaned and disinfected surface should not have any bacterial growth on the agar plate. Follow directions carefully and check the effectiveness of the process and chemicals for cleaning and disinfecting.

Activity C Steps

Part 1: Build Incubator - Active time 10 minutes

If your classroom/facilities already have an incubator (for animal reproduction, hatching eggs, or growing bacteria), you can use those. Alternatively, you can build a relatively inexpensive incubator rather quickly.

- Have each group put together their 12" x 12" box, taping the bottom and leaving the top open.
- Line the insides with the 1" styrofoam provided.
- Place the temperature sensor portion of your thermometer in the box to monitor temperature.
- Attach the 15-watt fluorescent light bulb to the provided socket. Plug this into the extension cord, then plug the cord into a nearby electrical socket.
- Place the light bulb so that it is suspended in the top of the box and not touching any surface. This is critical for safety reasons!
- Fold the top of the box (four-way fold) to close it. This will allow the box to be opened relatively easily - <https://youtu.be/LiQCdrAEBKg>

Module 1 - Cleaning and Disinfecting

- You may duct tape the bulb into place if desired (not required).
- Wait for your incubator to reach the desired temperature. (This typically takes about 90 minutes.) Your goal is to have an incubator between 35 and 37 degrees Celsius (95 - 98.6 degrees Fahrenheit). Different bacteria can grow over a range of temperatures, but you will have the most success by approximating body temperature in the incubator.

Part 2: Disinfecting - Approximately 25 minutes: perform after creating incubator.

1. Select four "dirty" items to be disinfected.
2. Have students use four different cleaning/disinfecting styles on selected items:
 - a. One item will be cultured without any cleaning or disinfecting occurring. They can knock off some of the organic material, wipe it off with a dry paper towel, etc. No wet cleaning should take place.
 - This will mimic how one might knock the loose mud/dirt/manure off their boots but not clean them appropriately.
 - b. One item will be "cleaned". Students may use soap and water how they might actually clean something in real life situations.
 - This will mimic how one might "clean" their boots. Many times, individuals will rinse boots off and scrub them a little, but not necessarily scrub them well enough to get all of the bacteria off.
 - c. One item will be sprayed with disinfectant without removing organic matter. Read and follow instructions for the chosen disinfectant, but DO NOT remove organic matter (aka clean) the item before applying the disinfectant. (Note: the chosen disinfectant may specify drying time.)
 - This is to mimic how one might think an object is clean due to the application of disinfectant, but how, without following proper disinfecting protocol, bacteria remain.
 - d. One item will be cleaned, with all organic matter being removed, then sprayed with disinfectant. Read and carefully follow instructions for the chosen disinfectant. (Note: this may involve allowing time to dry.)
 - This will demonstrate proper disinfecting protocol.
3. Culture each item by swabbing it with a sterile culture swab.
 - a. Streak the swab across the culture plates, taking care not to touch the inside of the plates with anything but the swab.
 - b. Place the lid back onto the plate and place it upside down into the incubator. This is to prevent condensation from dripping onto the agar.
 - c. Be sure to label each plate with the assigned "treatment".
4. Wait! It may take several days for your bacteria to grow, but check every 24 hours to compare between dirty, washed and disinfected items.
5. By day 2, ample growth should be present and a final comparison can take place.

Instructor Notes

This portion of the activity is relatively easy to implement, but agar plates will need several days in an incubator to see how effective the students were in cleaning and/or disinfecting their surfaces.

Perform this activity when students can meet again the following or next day. Be sure to have participants look for bacteria without opening the plates.

This activity tests for bacteria on surfaces, however many diseases are also caused by viruses which are unable to be visualized in class or in this experiment. This is a great time to use examples of some diseases of interest (e.g., by animal species or geography) caused by bacteria and viruses. This is an opportunity to discuss the potential commonalities of physical signs but the differences in treatments based on bacterial or viral origin.

Remind students that they will only be able to see bacteria growing on the agar plates, not viruses. Note that any bacteria that grows in the plates were already present in the environment (on the boot), since no new pathogen was introduced during the activity. Because you will not be identifying individual species of bacteria, you will not be identifying pathogenic or nonpathogenic bacteria! Have students follow the proper hand washing procedures after this activity and take care to properly dispose of plated bacteria, just in case.

Instructor Options

Depending on available time and scheduling, the instructor may build the incubators for use in the activity. This will ensure students have time to participate in the disinfectant activity while in class that day.

Preparation time is expected to increase by 20 to 30 minutes.

Taking it to the Farm

If students have access/desire to go, this laboratory can be set up to do some checking of different surfaces on a real farm. Or go get real boots, get them dirty, and run the cleaning and disinfecting experiment. Other options would be testing rags or cloths used on animals (healthy ones only!) or sponges to show how hard it is to disinfect (kill organisms) in some materials.

Many cattle operations have cleaning or disinfecting practices in place. Some options employed on farms include walking through foot baths and stepping on mats. All of these "good practices" can go bad in a variety of ways. If the disinfectant solution isn't regularly changed/refurbished or there is excess organic matter build up, the effectiveness of disinfection can be decreased considerably.

Consider testing the effectiveness of boot mats. An experiment can explore how often they need to be changed/cleaned/recharged/replaced and how much effectiveness they lose with organic matter or if they are dried out.

Discussion Questions

1. How successful were you in removing bacteria with your cleaning method?
2. Did bacteria grow on the plates from the disinfected boots that had not been cleaned? Why did that occur?
3. Which plates grew the least bacteria? Why?
4. What would you advise someone to do during a disease outbreak?
5. Are there alternatives to scrubbing and disinfecting boots? (plastic boot covers)
6. We studied boots (or other optional items). How hard would it be to clean and disinfect other items (fomites) that come into contact with manure, saliva, mucous etc.?

Instructor Notes:

SCRUB: Science Creates Real Understanding of Biosecurity

Student Guide

Module I Summary

Cleaning and Disinfecting Activities

Proper hygiene and sanitation are keys to reducing the spread of animal disease, and human diseases as well. Proper washing involves not only removing the visible dirt, but proper use of both detergents and disinfectants. The facilities which house animals and the materials with which they are constructed may make these tasks more difficult.

In this lab, we will explore your ability to scrub away the hidden germs on you, your footwear and materials that are commonly used to build animal enclosures.

Key concepts

What is a fomite?

How are animal diseases typically spread?

Video Links

WiscOnline Learning Module 1 – What is Biosecurity?

- <https://www.wisc-online.com/courses/1207/biosecurities/modules/what-is-biosecurity>

WiscOnline Learning Module 2 – Biosecurity: Routes of Infection and Means of Transportation

- <https://www.wisc-online.com/courses/1208/biosecurities/modules/biosecurity-routes-of-infection-and-means-of>

Goals & Learning Objectives

At the end of this activity, participants should be ready to do the following:

1. Explain what “animal biosecurity” is to friends or family members.
2. Emphasize the importance of proper cleaning techniques to limit disease spread.
3. Differentiate between surfaces/objects in animal environments which can harbor disease most easily and compare their ease in cleaning.
4. Identify the most effective cleaning and disinfecting methods used to limit disease spread.
5. Describe the most frequent cleaning/disinfecting mistakes which commonly occur, and the importance of following thorough cleaning and disinfectant instructions and protocols to eliminate pathogens.

Activity A: Effective Hand Washing - Student Summary

Initial Questions

1. Do you think you wash your hands properly?
2. Can you guess what parts of your hands you may miss when you wash?
3. Do you think you contaminate any other surfaces when you wash your hands?
4. Does shaking hands have the potential to transmit disease? Why or why not?

Effective Hand Washing Activity Steps

1. Apply a pea size drop of glo germ oil to your hands,
2. Wash your hands as you normally would.

How clean are they?

3. Now watch the video provided by World Health Organization.
 - <https://youtu.be/3PmVJQUCm4E>
4. Re-wash your hands using the technique discussed in the video.
5. Check your hands again to determine effectiveness.
6. Now examine all surfaces you may have encountered during the process (door knobs, counter tops). That's everywhere that has now been exposed to the "disease".

Discussion Questions

1. How effective was your initial hand washing? Where did "germs" still reside on your hands?
2. Did you contaminate any other surfaces?
3. How clean were your hands after following the procedure shown in the video?
4. What specifically did you do differently from the first time you washed your hands?
5. What could you do to limit disease spread through contact?
6. When working with animals, when would it be important to follow these hand washing recommendations?

Activity A: Effective Hand Washing - Student Handout

Initial Questions

1. Do you think you wash your hands properly?
2. Can you guess what parts of your hands you may miss when you wash?
3. Do you think you contaminate any other surfaces when you wash your hands?
4. Does shaking hands have the potential to transmit disease? Why or why not?

Activity A: Effective Hand Washing - Student Handout

Initial Questions

1. Do you think you wash your hands properly?
2. Can you guess what parts of your hands you may miss when you wash?
3. Do you think you contaminate any other surfaces when you wash your hands?
4. Does shaking hands have the potential to transmit disease? Why or why not?

Activity A: Effective Hand Washing - Student Handout

Discussion Questions

1. How effective was your initial hand washing? Where did "germs" still reside on your hands?
2. Did you contaminate any other surfaces?
3. How clean were your hands after following the procedure shown in the video?
4. What specifically did you do differently from the first time you washed your hands?
5. What could you do to limit disease spread through contact?
6. When working with animals, when would it be important to follow these hand washing recommendations?

Activity A: Effective Hand Washing - Student Handout

Discussion Questions

1. How effective was your initial hand washing? Where did "germs" still reside on your hands?
2. Did you contaminate any other surfaces?
3. How clean were your hands after following the procedure shown in the video?
4. What specifically did you do differently from the first time you washed your hands?
5. What could you do to limit disease spread through contact?
6. When working with animals, when would it be important to follow these hand washing recommendations?

Activity B: Facility Sanitation Challenge - Student Summary

Initial Questions

1. What type of animal facilities/objects do you interact with which would need to be cleaned and disinfected?
2. What kind of facilities did you have at shows/auctions you've attended?
3. What materials were the stalls and animal holding facilities constructed of?
4. Have you ever cleaned a facility before use?
5. If you have animals, what materials were used to construct your housing systems/facilities?

Facility Sanitation Challenge Activity Introduction

In this activity you will work together in teams to achieve the objective of getting a clean barn.

Discussion Questions

1. Was it better to clean materials quickly or thoroughly? What was the impact on the number of pathogens remaining?
2. What material was easiest to clean? Why?
3. Which materials would you recommend for use in your home facilities? Why?
4. What materials would you recommend for show facilities?
5. What would you do if your animal had to be housed in a facility with evidence of organic matter?

Activity B: Facility Sanitation Challenge - Student Handout

Initial Questions

1. What type of animal facilities/objects do you interact with which would need to be cleaned and disinfected?
2. What kind of facilities did you have at shows/auctions you've attended?
3. What materials were the stalls and animal holding facilities constructed of?
4. Have you ever cleaned a facility before use?
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Initial Questions

1. What type of animal facilities/objects do you interact with which would need to be cleaned and disinfected?
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3. What materials were the stalls and animal holding facilities constructed of?
4. Have you ever cleaned a facility before use?
5. If you have animals, what materials were used to construct your housing systems/facilities?

Activity B: Facility Sanitation Challenge - Student Handout

Discussion Questions

1. Was it better to clean materials quickly or thoroughly? What was the impact on the number of pathogens remaining?
2. What material was easiest to clean? Why?
3. Which materials would you recommend for use in your home facilities? Why?
4. What materials would you recommend for show facilities?
5. What would you do if your animal had to be housed in a facility with evidence of organic matter?

Activity B: Facility Sanitation Challenge - Student Handout

Discussion Questions

1. Was it better to clean materials quickly or thoroughly? What was the impact on the number of pathogens remaining?
2. What material was easiest to clean? Why?
3. Which materials would you recommend for use in your home facilities? Why?
4. What materials would you recommend for show facilities?
5. What would you do if your animal had to be housed in a facility with evidence of organic matter?

Activity C: Cleaning and Disinfecting - Student Summary

Initial Questions

1. Is there a difference between cleaning and disinfecting an item or facility?
2. Do you think spraying disinfect on boots eliminates the need to clean them?
3. Can you spray disinfectant on your stall walls at a show when you arrive without cleaning them?
4. Do you have to follow instructions on disinfectants in order for them to be effective?

Cleaning and Disinfecting Activity Introduction

The importance of proper cleaning and following manufactures guidelines can be readily evaluated and visualized through the growth of bacteria on items improperly cleaned and/or disinfected. This activity has two sections, of which either or both can be planned and executed in one or more sessions. The first activity involves creating an incubator out of commonly available materials. The process will help participants understand the components and their contribution to the final product. Part 2 puts the incubator to use, while testing several different levels of cleaning and disinfecting fomites (often boots) that can carry disease causing bacteria found in the barn.

This activity brings to light the difficulty of cleaning and disinfecting surfaces properly. Rough boot treads can provide refuge for bacteria even with heavy scrubbing. By using common methods to clean, disinfect, or both; swabbing the surface, streaking the agar plate, and incubating the plates, participants can watch for bacterial growth. A properly cleaned and disinfected surface should not have any bacterial growth on the agar plate. Follow directions carefully and check the effectiveness of the process and chemicals for cleaning and disinfecting.

Discussion Questions

1. How successful were you in removing bacteria with your cleaning method?
2. Did bacteria grow on the plates from the disinfected boots that had not been cleaned? Why did that occur?
3. Which plates grew the least bacteria? Why?
4. What would you advise someone to do during a disease outbreak?
5. Are there alternatives to scrubbing and disinfecting boots? (plastic boot covers)
6. We studied boots (or other optional items). How hard would it be to clean and disinfect other items (fomites) that come into contact with manure, saliva, mucous etc.?

Activity C: Cleaning and Disinfecting - Student Handout

Initial Questions

1. Is there a difference between cleaning and disinfecting an item or facility?
2. Do you think spraying disinfect on boots eliminates the need to clean them?
3. Can you spray disinfectant on your stall walls at a show when you arrive without cleaning them?
4. Do you have to follow instructions on disinfectants in order for them to be effective?

Activity C: Cleaning and Disinfecting - Student Handout

Initial Questions

1. Is there a difference between cleaning and disinfecting an item or facility?
2. Do you think spraying disinfect on boots eliminates the need to clean them?
3. Can you spray disinfectant on your stall walls at a show when you arrive without cleaning them?
4. Do you have to follow instructions on disinfectants in order for them to be effective?

Activity C: Cleaning and Disinfecting - Student Handout

Discussion Questions

1. How successful were you in removing bacteria with your cleaning method?
2. Did bacteria grow on the plates from the disinfected boots that had not been cleaned? Why did that occur?
3. Which plates grew the least bacteria? Why?
4. What would you advise someone to do during a disease outbreak?
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6. We studied boots (or other optional items). How hard would it be to clean and disinfect other items (fomites) that come into contact with manure, saliva, mucous etc.?

Activity C: Cleaning and Disinfecting - Student Handout

Discussion Questions

1. How successful were you in removing bacteria with your cleaning method?
2. Did bacteria grow on the plates from the disinfected boots that had not been cleaned? Why did that occur?
3. Which plates grew the least bacteria? Why?
4. What would you advise someone to do during a disease outbreak?
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6. We studied boots (or other optional items). How hard would it be to clean and disinfect other items (fomites) that come into contact with manure, saliva, mucous etc.?



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SCRUB: Science Creates Real Understanding of Biosecurity Instructor Guide

Module 2

Direct and Indirect Disease Transfer

Authors: Kris Hiney, Betsy Greene, and Brittani Kirkland

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Instructor Notes:

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Introduction

Significant diseases that impact animal agriculture can often spread quickly, with no visible signs. Animals can be exposed through both direct (nose to nose, skin contact, etc.) and indirect contact (shared grooming tools or tack, contaminated water buckets, etc.). Often the humans will not realize their animal has been exposed until several days later after the disease has gone through the incubation time period. By this time, the animal may have returned home and infected other healthy animals if precautions are not taken. Veterinarians and animal health officials may need to backtrack to find the animal of origin. This laboratory will explore the dynamics of disease transmission, and how a highly contagious disease can spread quickly.

Key Concepts

- What is a disease?
- Why should we be concerned with them?
- How are they transmitted?
- How do diseases impact society?

Goals & Learning Objectives

1. Define disease characteristics, disease types, and how transmission occurs.
2. Compare transmission types of various animal diseases.
3. Analyze animal susceptibility to various diseases and how to minimize risk.
4. Recommend animal biosecurity measures to limit disease spread that accounts for the specie, individual susceptibility, and disease types.

Setting the Scene

Instructors should initiate the exercise by going through an example story of an animal disease outbreak. Multiple examples are provided in Appendix B. As a discussion item, the economic impact of the disease can be discussed in class or provided as a student activity following the exercise.

Suggested Instructor Scenario

Create a scenario where students represent animals in a sale barn or an animal exhibition event. Ideally, animals would have been tested for significant diseases or have health certificates prior to “attending the sale or exhibition”. In this scenario, one “animal” will have been asymptomatic or a carrier of a disease of significance. Trace its path of outbreak.

Other scenarios can be created to be more directly applicable to the animals with which the students are working (if any). For example, a horse club may have a scenario with a shared water trough, tight gathering at the entry to the show arena, etc. Any horse/livestock species may use shared tools or common areas in the barn (e.g. wash rack, cross ties, clipping stands, etc.). Small stock and poultry students may have scenarios with open wire display cages that have ventilation/airflow spreading the disease. The more realistic that the scenario is to the students if they have animals that they exhibit or show, the more they will recognize the potential risks to their own animals.

Activity A: Disease Transfer Lab

Activity Objective

To help students understand the ease of which an infected animal (with no visible signs) can transfer diseases to other animals with minimal contact or effort. In this case, the students can “become” the animals mingling together and unknowingly sharing “disease” with their peers. After they (their cups) get tested, then they can learn how to trace back to identify the original diseased animals based on common contacts.

Total Time Approximately 45 minutes	Preparation: 30 minutes Active: 15 minutes Wait: 0 minutes	Difficulty Level Easy	Suggested Group Size Class
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Materials

Teacher

Items to Purchase or Included in Kit

- 2 stirrers/popsicle sticks for preparation
- Povidone/Iodine solution (generic Betadine)
- 1 plastic spoon
- Cornstarch
- Powered Milk

Additional Items Needed

- Water

Students

Items to Purchase or Included in Kit

- 25 small cups (5 oz) (1 per student)
- 25 stirrer/popsicle sticks (1 per student)
- 2 marked dixie cups for measuring water

Additional Items Needed

- Water

Activity Links

WiscOnline Learning Module 1 – What is Biosecurity?

- <https://www.wisc-online.com/courses/1207/biosecurities/modules/what-is-biosecurity>

WiscOnline Learning Module 2 – Biosecurity: Routes of Infection and Means of Transportation

- <https://www.wisc-online.com/courses/1208/biosecurities/modules/biosecurity-routes-of-infection-and-means-of>

Disease transmission workshop overview for instructor

- <https://youtu.be/IRVjIMHp5pc>

Setup/Preparation – approximately 30 minutes

1. Instructor prepares cups prior to experiment.
2. Add 3 heaping spoonfuls of dried milk powder to each “healthy” cup.
3. To the “sick” cup, add 2 heaping spoonfuls of dried milk powder and 1 heaping spoonful of cornstarch.
4. Use a ratio of 1 sick (one with cornstarch) per 10 students.
5. Stir the mixture together to disguise it from the student.
6. Make the “healthy” cups with only the powdered milk first then the “sick” cups with the powdered milk and cornstarch to prevent cross contamination. Be sure to not use the same stirrer for “sick” and “healthy” cups.

Initial Engagement Questions

1. When you take your animal to a fair/show, what are concerns that you may have regarding your animal's health?
possible answers: direct or indirect exposure to sick animals, e.g. nose to nose vs contaminated shared water/tools/equipment, respectively
2. What are some signs that you might see in a sick animal?
possible answers: use visual/visible rather than "measurable" cues, such as animal not eating, snotty nose, lethargic, away from herd, etc., as opposed to high temperature.
3. How would you prevent your animal from coming into contact with any sick animals?
possible answers: no shared tools, water sources, equipment, no nose to nose contact, separation between your stalls/pens and others, etc.
4. What are some other situations/scenarios where you might be concerned about a healthy animal getting exposed to sick animals?
possible answers: sales animals sharing pens, bringing a new animal home to your healthy animals, shared water troughs, etc.

Disease Transfer Activity Introduction

Present the scenario of your choice to the students, and explain that as the animals, they are going to mingle (in the pen, at the gate, etc.) with two different "animals" during the activity. Clearly present the ground rules (how students will record who they mingle with, how to "exchange fluids", no drinking out of cup, no changing cups, etc.). Note: The student as an animal scenario is used to decrease the possibility of students picking on an individual (he/she is contaminated).

Activity A Steps - approximately 15 minutes

1. Each student receives one cup with the "milk" powder and a popsicle stick.
2. Students will measure and add 40 ml of water (about 3 Tablespoons or 1/3 of a dixie cup) to each cup and stir together with their own popsicle stick. There are two cups in your SCRUB kit marked with a water measurement line that can be used. Be sure to inform students not to share popsicle sticks and not to drink the contents of their cups.
3. Students will then exchange "bodily fluids" with another student in the classroom and record the "giver" and "receiver" on a chart or in their notebook. To do this, one student will pour all the contents of their cup into the other student's cup, pour back to the original cup, and then split in half between the cups. Do not allow students to switch cups.
4. Have students record the name of each student they exchanged fluids with.
5. Repeat for 2 rounds, with students keeping either an "individual" record of exposures, or having them record them on a worksheet or white board (example below).
6. Tips: Encourage the youth to be silent and not to guess about the contents of the cups. And, do not tell them there are different cups.
7. Make sure that each student has exchanged cup contents with at least one other person.

Example Worksheet/Whiteboard

	Student Name (Giver)	First Round Receiver	Second Round Receiver
1			
2			
3			
4			
5			

Diagnosis

8. Test for the presence of the ill "animal" (student).
9. The instructor will drop 8 drops of Betadine solution in each cup and the student will stir immediately afterward.
10. If "infected", the color will be a murky purple. They need to record their status immediately, as the color does fade.
11. If they are not "infected" the Betadine tends to stay on top or when mixed will just briefly be a bit orange.

Finding the Infected Patient

12. Using the charts and sharing cup recipients infected students, try to trace back to the original "sick" animal(s).
13. Have the students look at the worksheets and the names of students infected to identify patient zero. Cross out any name of students (animals) who are not sick, or whose cup did not change color.
14. From the infected group, then eliminate any individual who first encountered a healthy person. If they had been patient zero, that individual would have also come up as sick.

Instructor Notes

1. Be sure to take caution with the area the activity is performed, since iodine will stain carpets, clothing, etc.
2. Make sure to explain the rules before passing out the cups.
3. Depending on the age/maturity level of your students, it often works best to have a few stations where students can measure out water, maybe matching up with their first recipient to help each other measure the water.
4. If you are conducting this activity with a multi-age audience, you may want to have an older youth pair with a younger one as the "animal" and "handler" to help with or decrease spillage possibilities.

Discussion Questions

1. Can we identify the initial infected students? What evidence do you have?
2. Would the disease transfer rate be different depending on the virulence or how contagious the disease is?
 - Tips: may want to talk about how cornstarch was diluted, but bacteria/viruses would instead replicate and keep going.
3. What if we had vaccinated some of the cups? When might vaccination fail?
 - Note: we will revisit this concept in a later lab.
4. In this lab, we mimicked the exchange of bodily fluids. What if the disease was transmitted in a different manner?
5. What animal diseases are transmitted via other methods (see Appendix A). List three diseases transferred via different routes of transmission.
6. How could we prevent this disease outbreak in our scenario?
7. How could we have limited or prevented its spread?
8. What animals would be more susceptible to contracting the disease? How would you minimize their risk?
9. Think about what animal biosecurity measures we could put in place to limit disease spread via direct transmission of bodily fluids, etc.

Instructor Notes:

SCRUB: Science Creates Real Understanding of Biosecurity

Student Guide

Module 2 Summary

Direct and Indirect Disease Transfer

Introduction

Significant diseases that impact animal agriculture can often spread quickly, with no visible signs. Animals can be exposed through both direct (nose to nose, skin contact, etc.) and indirect contact (shared grooming tools or tack, contaminated water buckets, etc.). Often the humans will not realize their animal has been exposed until several days later after the disease has gone through the incubation time period. By this time, the animal may have returned home and infected other healthy animals if precautions are not taken. Veterinarians and animal health officials may need to backtrack to find the animal of origin. This laboratory will explore the dynamics of disease transmission, and how a highly contagious disease can spread quickly.

Key Concepts

- What is a disease?
- Why should we be concerned with them?
- How are they transmitted?
- How do diseases impact society?

Goals & Learning Objectives

1. Define disease characteristics, disease types, and how transmission occurs.
2. Compare transmission types of various animal diseases.
3. Analyze animal susceptibility to various diseases and how to minimize risk.
4. Recommend animal biosecurity measures to limit disease spread that accounts for the specie, individual susceptibility, and disease types.

Activity A: Disease Transfer Lab - Student Summary

Initial Questions

1. When you take your animal to a fair/show, what are concerns that you may have regarding your animal's health?
2. What are some signs that you might see in a sick animal?
3. How would you prevent your animal from coming into contact with any sick animals?
4. What are some other situations/scenarios where you might be concerned about a healthy animal getting exposed to sick animals?

Disease Transfer Activity Steps

Follow the directions provided by your instructor for the disease transfer activity.

Discussion Questions

1. Can we identify the initial infected students? What evidence do you have?
2. Would the disease transfer rate be different depending on the virulence or how contagious the disease is?
3. What if we had vaccinated some of the cups? When might vaccination fail?
4. In this lab, we mimicked the exchange of bodily fluids. What if the disease was transmitted in a different manner?
5. What animal diseases are transmitted via other methods (see Appendix A). List three diseases transferred via different routes of transmission.
6. How could we prevent this disease outbreak in our scenario?
7. How could we have limited or prevented its spread?
8. What animals would be more susceptible to contracting the disease? How would you minimize their risk?
9. Think about what animal biosecurity measures we could put in place to limit disease spread via direct transmission of bodily fluids, etc.

Activity A: Disease Transfer Lab - Student Handout

Initial Questions

1. When you take your animal to a fair/show, what are concerns that you may have regarding your animal's health?
2. What are some signs that you might see in a sick animal?
3. How would you prevent your animal from coming into contact with any sick animals?
4. What are some other situations/scenarios where you might be concerned about a healthy animal getting exposed to sick animals?

Activity A: Disease Transfer Lab - Student Handout

Initial Questions

1. When you take your animal to a fair/show, what are concerns that you may have regarding your animal's health?
2. What are some signs that you might see in a sick animal?
3. How would you prevent your animal from coming into contact with any sick animals?
4. What are some other situations/scenarios where you might be concerned about a healthy animal getting exposed to sick animals?

Activity A: Disease Transfer Lab - Student Handout

Discussion Questions

1. Can we identify the initial infected students? What evidence do you have?
2. Would the disease transfer rate be different depending on the virulence or how contagious the disease is?
3. What if we had vaccinated some of the cups? When might vaccination fail?
4. In this lab, we mimicked the exchange of bodily fluids. What if the disease was transmitted in a different manner?
5. What animal diseases are transmitted via other methods (see Appendix A). List three diseases transferred via different routes of transmission.
6. How could we prevent this disease outbreak in our scenario?
7. How could we have limited or prevented its spread?
8. What animals would be more susceptible to contracting the disease? How would you minimize their risk?
9. Think about what animal biosecurity measures we could put in place to limit disease spread via direct transmission of bodily fluids, etc.

Activity A: Disease Transfer Lab - Student Handout

Discussion Questions

1. Can we identify the initial infected students? What evidence do you have?
2. Would the disease transfer rate be different depending on the virulence or how contagious the disease is?
3. What if we had vaccinated some of the cups? When might vaccination fail?
4. In this lab, we mimicked the exchange of bodily fluids. What if the disease was transmitted in a different manner?
5. What animal diseases are transmitted via other methods (see Appendix A). List three diseases transferred via different routes of transmission.
6. How could we prevent this disease outbreak in our scenario?
7. How could we have limited or prevented its spread?
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SCRUB: Science Creates Real Understanding of Biosecurity Instructor Guide

Module 3

Vaccines and Proper Handling

Authors: Betsy Greene, Kris Hiney, and Brittani Kirkland

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Acknowledgments



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Introduction

Vaccination protocols are a key component of a good animal health and biosecurity plan. Vaccination plans may differ significantly between animals and species. The plans must be created according to species, disease transmission risk, age of the animal, potential exposure to other animals, amount of travel, etc. Vaccine effectiveness can be severely impacted by improper storage (either hot or cold) during anytime between manufacturing, shipping, storage, and administration/injection.

Key Concepts

- What is a vaccine?
- How does handling affect vaccine effectiveness?
- Which diseases have vaccines available?
- If vaccines are not available, what other methods are available to limit disease spread?

Goals & Learning Objectives

1. Identify which animal diseases of importance have vaccines and which do not.
2. Identify what types of vaccines are available.
3. Understand how handling affects vaccines effectiveness.
4. Be able to create appropriate coolers suitable for housing vaccines out of common household materials.
5. Create a vaccination plan for their species of interest.

Setting the Scene

Provide a real-world example of an animal disease (ie. Foot and Mouth Disease or FMD, Vesicular Stomatitis, etc.) and how it is spread. Examples are found in Appendix A. Instructors are provided with an animal disease chart which lists species, disease, symptoms, route of transmission and if it is zoonotic. Choose diseases which may be of the youth's interest.

Activity A: Importance of Vaccines and Proper Handling

Activity Objective

1. Identify which animal diseases of importance have vaccines and which do not.
2. Identify what types of vaccines are available.
3. Understand how handling affects vaccines effectiveness.

Total Time	Preparation: 0 minutes	Difficulty Level	Suggested Group Size
Approximately 30 minutes	Active: 30 minutes Wait: 0 minutes	Easy	Individual, Small Group, or Class

Materials

- Provided supplemental materials and/or internet access.

Activity Links

Center for Food Security and Public Health

- <https://www.cfsph.iastate.edu/diseaseinfo/>

USDA APHIS

- <https://www.aphis.usda.gov/aphis/resources/pests-diseases>

Equine Diseases

- <https://www.equinediseasecc.org/>

American Association of Equine Practitioners

- <https://aaep.org/horsehealth/science-behind-veterinarian-administered-vaccines>

Setup/Preparation – approximately 5 minutes

1. Identify diseases/species of interest and create an age/experience appropriate visual (e.g. a sheet with a horse outline and story- e.g. pregnant mare, and several index cards with vaccines for horses, diseases, and types of vaccine- e.g. modified live, killed, etc.
2. Provided supplemental Appendix A.

Activity Introduction

Vaccination protocols are a key component of a good animal health and biosecurity plan. Vaccination plans may differ significantly between animals and species. The plans must be created according to species, disease transmission risk, age of the animal, potential exposure to other animals, amount of travel, etc. Vaccine effectiveness can be severely impacted by improper storage (either hot or old) during anytime between manufacturing, shipping, storage, and administration/injection.

Activity A Steps - approximately 30 minutes

Using the provided supplement materials in the activity background and diseases of importance to animals in Appendix A, or searches of the internet, have the students answer the discussion questions.

Additional Optional Activity for Better Engagement and Understanding:

1. Depending on the age and experience of the youth or students, you can change the rigor of content and expectations of the students. For inexperienced youth, you may have one horse, one vaccine, and one disease card, have youth find their matching specie/vacc/disease. Then have them present to the rest about their disease/vacc/specie.
2. An older or more experienced group could have a bulletin board with a column of species, a column of diseases, a column of vaccinations (including a card with No Vaccine), and a column of vaccine types. Individuals or teams could be assigned a specie and research all the diseases/vaccines, etc.

Instructor Notes

- Following your activities, jot down changes that you would make for the next time, what worked and what didn't work for your particular audience.

Discussion Questions

1. What are the most common diseases found in their animals? (Use Appendix A or help students identify dependable and high-quality internet resources such as USDA APHIS, etc.)
2. Which of these diseases have a vaccine available for use to protect the animals? (Discuss certain types of physiologic states of animals that may be indicated/contraindicated for certain types or timing of vaccinations, such as a pregnant mare needing the Killed vaccine for Equine Rhinopneumonitis (Equine Herpes Virus), since modified live may cause the mare to abort.)
3. What type of vaccines are they? (If there is a vaccine, identify the type, Toxoid, Modified Live, Killed, etc. You can discuss the difference between the types of vaccines.)
4. Which require careful handling? (All vaccines do, but timing, temperature-too hot or cold, exposure to sunlight, are good discussion points.)
5. Are there other common vaccines given to a horse, cow, sheep etc.? (This depends on how you organize and conduct the activity, as to whether or not this question will be used, but Appendix A gives you a quick summary of many of the animal diseases and vaccinations.)
6. Needles should be changed every time you fill a syringe or a vaccine gun. Don't put a used needle into a vaccine container. Why is that suggestion made? (The potential contamination of your vaccine can occur if you vaccinate an animal that is already sick. Also, you should not introduce anything that is not sterile to the vaccine, or you may end up introducing that contamination to another animal, resulting in potential infection or abscess, or worse.)

Activity B: Cooler Building Lab

Activity Objective

1. Understand how handling affects vaccines effectiveness.
2. Be able to create appropriate coolers suitable for housing vaccines out of common household materials.

Total Time	Preparation: 15 minutes	Difficulty Level	Suggested Group Size
Approximately 25 hours, 40 minutes	Active: 25 minutes Wait: 25 hours	Intermediate	Five per group Total of five groups

Material

Items to Purchase or Included in Kit (divide between 5 groups) - some materials will be reused in incubator building activity

- 5 boxes (@12"x12"x12")
- 2 rolls Duct Tape
- 30 Styrofoam pieces
- 10 additional cardboard pieces

- 5 indoor/outdoor thermometers
- 20 AAA batteries (for thermometer)

Additional Items Needed

- 6 to 10 - 16.9 oz **frozen** water bottles per group (put in freezer at least 24 hours ahead to be completely frozen)
- "Vaccine" – the internal thermometer or test strip will be placed where a fake vaccine would be; instructors can use a vial/syringe etc. as the vaccine.

Activity Links

Vaccine cooler building activity overview for instructor

- <https://youtu.be/32ETU-SukAY>

Setup/Preparation – approximately 15 minutes

1. Gather materials for each group (see above).
2. Water bottles will need to be frozen 24 hours before activity, and they can either be conditioned by the instructor or the students, depending upon your access to warm water, and/or time for the activity.

Initial Engagement Questions

1. How does handling affect vaccine effectiveness?
2. Which diseases have vaccines available?
3. If vaccines are not available, what other methods are available to limit disease spread?

Activity Introduction

Power's out! In this activity, students will test cooler designs that may be employed during an emergency situation where the electricity goes out and vaccinations in refrigerated storage are at risk. This can also be used to demonstrate how a rancher could easily create a cooler for onsite use at their ranch to maintain temperatures of vaccinations while working cattle or other livestock. Since temperatures both higher and lower than the recommended temperature levels (most commonly 35-45 degrees F) for vaccinations can render them ineffective, an appropriate cooler (whether built or an existing cooler adapted) can protect the vaccines from environmental temperatures.

Activity B Steps - approximately 25 minutes plus 25 hours wait time

1. Construct box. Tape the bottom of the box and leave the top open.
2. Condition water bottles to gain the maximum cooling performance from them.
3. Place the bottles in a sink or cooler with lukewarm water. Wait until the outer layer of ice melts or the ice spins freely in the bottle. Dry off bottles once conditioned.
4. Place however many conditioned water bottles wanted into the box (Use at least 3 bottles.)
5. Place a piece of cardboard on top of bottles.
6. Place a layer of bubble wrap or Styrofoam above the cardboard. (This must be 1" thick.)
7. Place external thermometer monitor on top of insulation.
8. Add another layer of insulation. (This should be at least 1" thick.)
9. Add another layer of cardboard.
10. Add remaining conditioned water bottles.

11. Wait 1 hour

12. Add vaccine between layers of insulation (where the external thermometer reader was placed).

13. Wait 24 hours

14. Look at thermometers/test strips to determine if the cooler remained cold enough for the vaccine.

Instructor Notes

You can use a hard sided or Styrofoam cooler instead of box provided: don't use a soft sided cooler. Use 16.9 oz bottles for medium or larger coolers, use 8 oz bottles for small coolers.

Instructor Options**Engineering Design Contest**

Note: For this option, materials may be used in a way that makes them unusable in the future. For this reason, it is suggested that more items be provided for use. Adding additional insulation and cardboard materials is recommended.

1. Provide teaser physics questions to provoke thoughts for cooler design. Idea: Don't answer these questions, just allow the students to think about them before designing.
 - How does heat transfer?
 - Do solids or liquids transfer heat easier?
 - What would be best to ensure it is cooler faster?
 - What temperatures should the vaccines be at? How would this affect the proximity to the water bottles?
2. Allow students to construct the boxes in whatever way they think is best to keep the vaccines cool. Inform them that their coolers will need to be ready for vaccines within an hour.
 - Note: This step is why some materials may not be reusable, as some students may change the structure of supplies provided.
 - At least one team should follow the recommended directions. Other teams may be allowed to build incorrectly to determine the outcome.

Module 3 - Vaccines and Proper Handling

3. Wherever students would like their vaccine to be placed in their cooler, they should insert the external thermometer so the temperature of that area can be regulated.
4. Once students have completed their construction, discuss their designs and why they feel their box will provide the proper temperatures.
5. Things you may potentially encounter and responses:
 - Vaccines directly against the ice - too cold.
 - Unconditioned water bottles - not releasing cool temperatures fast enough.
 - Not enough insulation/vaccine close to cooler edge - too exposed to environmental effects.
6. Wait 1 hour.
7. Add vaccine between layers of insulation (where the external thermometer reader was placed).
8. Wait 24 hours.
9. Look at thermometers/test strips to determine if the cooler remained cold enough for the vaccine.
10. Award team with best designed cooler.

For Further Investigation

Check the school's refrigerator temperature or ask students to check temperatures at home.

Discussion Questions

1. Do you or your family purchase vaccines for your animals?
2. Do you bring a cooler to the store?
3. How do you handle vaccines during transport, wait time and administration to herd animals?
4. In your geographic area or environment, is the vaccine more likely to get too hot or too cold?
5. Knowing the temperature vaccines should stay at, what should those handling vaccines think about when preparing to vaccinate in a barn, field, etc.?

Activity C: Design a Vaccination Protocol (optional)

Activity Objective

1. Identify animal diseases of importance to your species or geographic location.
2. Identify what types of vaccines are available for those diseases.
3. Create a vaccination plan for their species of interest.

Total Time 30 to 45 minutes	Preparation: 0 minutes Active: 30 to 45 minutes Wait: 0 minutes	Difficulty Level Intermediate	Suggested Group Size Small Group
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Materials

- Internet access.

Activity Links

USDA APHIS

- <https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information>

Center for Food Security and Public Health

- <https://www.cfsph.iastate.edu/>

American Association of Equine Practitioners

- <https://aaep.org/horse-owners/owner-guidelines/owner-vaccination-guidelines>

Initial Engagement Questions

1. What species of animals do you have on your farm?
2. What diseases are common for your species of choice or in your geographical region?
3. Which of these diseases have vaccination options?
4. What is the veterinarian recommended protocol for first time vaccination (is it different for young, old, lactating, etc. animals?)
5. Are there annual or more frequent booster vaccinations required?
6. Are there differences in recommendations for an animal that travels to exhibitions or competitions?

Activity Introduction

Assign students to a team to develop a vaccination protocol for their farm. They should consider the species of animals, the type of animals (breeding, exhibition etc.) and their location.

Activity C Steps - approximately 30 to 45 minutes

Use internet resources to develop a vaccination protocol.

Instructor Notes

This activity can be adapted to whatever level of youth or students with which you are working. If you have young and/or inexperienced people, you could use flash cards with species, diseases, or vaccinations. For more experience or older students, they can research one or multiple species vaccination requirements.

Discussion Questions

1. What vaccines would you recommend?
 2. When should they be given?
 3. What type of vaccines should be used?
 4. What costs should be included in your vaccination plan (equipment, labor, cost of vaccine)?
-

Background Information

Vaccines are substances that are provided to an animal or human to stimulate the immune system to protect it or provide resistance from a particular disease. Essentially vaccines trigger the body to “recognize” the pathogen whether it is bacteria, virus or a substance produced by them and destroy it with antibodies. Vaccines can be administered through a variety of routes (injections, through mucus membranes or even orally). Vaccines come in a number of types: live, killed, recombinant, and toxoids.

Live vaccines - Live vaccines are often referred to as attenuated or modified. This means that the actual organism is alive in the vaccine, but it is in a weakened state. It can still cause the immune system to react but does not cause the disease to occur to the same extent. These vaccines typically last longer and do not need to have boosters given as often. Not all animals can be given modified live vaccines such as pregnant cows or calves. These vaccines must be handled more carefully as they are at more risk of damage from temperature and light.

Killed vaccines - In killed vaccines the bacteria or virus is killed through heat or chemicals. These vaccines do not create as big of an immune response as live attenuated vaccines; therefore, they typically need more frequent boosters. Killed vaccines are safer for animals and people with weakened immune systems or who may be pregnant.

Recombinant vaccines - Recombinant vaccines use a piece of DNA from the pathogen that codes for or creates a part of the pathogen the immune system would recognize. That DNA is then inserted into bacterial or mammalian cells. These cells then create more of the antigen which is then purified and placed into a vaccine. As this is only a part of the pathogen, it can't reproduce or cause diseases.

Toxoid vaccines - sometimes it is a product of a bacteria that is actually harmful to an animal or person. The toxins produced by the bacteria are inactivated and are now called toxoids. The immune system learns to fight off the toxin by recognizing the harmless toxoid.

Vaccine Handling and Storage

For vaccines to be effective, they must be handled and stored properly. Most vaccines must be stored in a refrigerator at temperatures between 35 and 45 F. Both heat and freezing can make them ineffective. Exposure to sunlight can also make the vaccine ineffective. Injecting animals with poorly handled vaccines does nothing to help protect them from diseases. Unfortunately, many producers and retailers' refrigerators may not be at the proper temperature.

When reconstituting modified live vaccines (these are typically dried into a cake and must have a specific liquid added back to them), vaccines must be used within 2 hours and must be kept in a cooler and out of the sunlight. Do not prepare vaccines before animals/equipment and operators are in place. Never use a vaccine that has been frozen. Coolers should be cooled (ice packs added) one hour prior to their use. Only ever put as much vaccine in the cooler as would be used within a few hours.

SCRUB: Science Creates Real Understanding of Biosecurity Student Guide

Module 3 Summary Vaccines and Proper Handling

Introduction

Vaccination protocols are a key component of a good animal health and biosecurity plan. Vaccination plans may differ significantly between animals and species. The plans must be created according to species, disease transmission risk, age of the animal, potential exposure to other animals, amount of travel, etc. Vaccine effectiveness can be severely impacted by improper storage (either hot or old) during anytime between manufacturing, shipping, storage, and administration/injection.

Key Concepts

- What is a vaccine?
- How does handling affect vaccine effectiveness?
- Which diseases have vaccines available?
- If vaccines are not available, what other methods are available to limit disease spread?

Goals & Learning Objectives

1. Identify which animal diseases of importance have vaccines and which do not.
2. Identify what types of vaccines are available.
3. Understand how handling affects vaccines effectiveness.
4. Be able to create appropriate coolers suitable for housing vaccines out of common household materials.
5. Create a vaccination plan for their species of interest.

Activity A: Importance of Vaccines and Proper Handling - Student Summary

Activity Introduction

Vaccination protocols are a key component of a good animal health and biosecurity plan. Vaccination plans may differ significantly between animals and species. The plans must be created according to species, disease transmission risk, age of the animal, potential exposure to other animals, amount of travel, etc. Vaccine effectiveness can be severely impacted by improper storage (either hot or old) during anytime between manufacturing, shipping, storage, and administration/injection.

Importance of Vaccines and Proper Handling Steps

Using the materials provided by your instructor or searches of the internet, answer the discussion questions.

Discussion Questions

1. What are the most common diseases found in your animals?
2. Which of these diseases have a vaccine available for use to protect the animals?
3. What type of vaccines are they?
4. Which require careful handling?
5. Are there other common vaccines given to a horse, cow, sheep etc.?
6. Needles should be changed every time you fill a syringe or a vaccine gun. Don't put a used needle into a vaccine container. Why is that suggestion made?

Activity A: Importance of Vaccines and Proper Handling - Student Handout

Discussion Questions

1. What are the most common diseases found in your animals?
2. Which of these diseases have a vaccine available for use to protect the animals?
3. What type of vaccines are they?
4. Which require careful handling?
5. Are there other common vaccines given to a horse, cow, sheep etc.?
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Activity A: Importance of Vaccines and Proper Handling - Student Handout

Discussion Questions

1. What are the most common diseases found in your animals?
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6. Needles should be changed every time you fill a syringe or a vaccine gun. Don't put a used needle into a vaccine container. Why is that suggestion made?

Activity B: Cooler Building Lab - Student Summary

Activity Introduction

Power's out! In this activity, students will test cooler designs that may be employed during an emergency situation where the electricity goes out and vaccinations in refrigerated storage are at risk. This can also be used to demonstrate how a rancher could easily create a cooler for onsite use at their ranch to maintain temperatures of vaccinations while working cattle or other livestock. Since temperatures both higher and lower than the recommended temperature levels (most commonly 35-45 degrees F) for vaccinations can render them ineffective, an appropriate cooler (whether built or an existing cooler adapted) can protect the vaccines from environmental temperatures.

Initial Questions

1. How does handling affect vaccine effectiveness?
2. Which diseases have vaccines available?
3. If vaccines are not available, what other methods are available to limit disease spread?

Cooler Building Activity Steps

1. Construct box. Tape the bottom of the box and leave the top open.
2. Condition water bottles to gain the maximum cooling performance from them.
3. Place the bottles in a sink or cooler with lukewarm water. Wait until the outer layer of ice melts or the ice spins freely in the bottle. Dry off bottles once conditioned.
4. Place however many conditioned water bottles wanted into the box (Use at least 3 bottles.)
5. Place a piece of cardboard on top of bottles.
6. Place a layer of bubble wrap or Styrofoam above the cardboard. (This must be 1" thick.)
7. Place external thermometer monitor on top of insulation.
8. Add another layer of insulation. (This should be at least 1" thick.)
9. Add another layer of cardboard.
10. Add remaining conditioned water bottles.

11. Wait 1 hour

12. Add vaccine between layers of insulation (where the external thermometer reader was placed).

13. Wait 24 hours

14. Look at thermometers/test strips to determine if the cooler remained cold enough for the vaccine.

Discussion Questions

1. Do you or your family purchase vaccines for your animals?
2. Do you bring a cooler to the store?
3. How do you handle vaccines during transport, wait time and administration to herd animals?
4. In your geographic area or environment, is the vaccine more likely to get too hot or too cold?
5. Knowing the temperature vaccines should stay at, what should those handling vaccines think about when preparing to vaccinate in a barn, field, etc.?

Activity B: Cooler Building Lab - Student Handout

Initial Questions

1. How does handling affect vaccine effectiveness?
2. Which diseases have vaccines available?
3. If vaccines are not available, what other methods are available to limit disease spread?

Activity B: Cooler Building Lab - Student Handout

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Activity B: Cooler Building Lab - Student Handout

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4. In your geographic area or environment, is the vaccine more likely to get too hot or too cold?
5. Knowing the temperature vaccines should stay at, what should those handling vaccines think about when preparing to vaccinate in a barn, field, etc.?

Activity C: Design a Vaccination Protocol - Student Summary

Activity Objective

1. Identify animal diseases of importance to your species or geographic location.
2. Identify what types of vaccines are available for those diseases.
3. Create a vaccination plan for your species of interest.

Initial Engagement Questions

1. What species of animals do you have on your farm?
2. What diseases are common for your species of choice or in your geographical region?
3. Which of these diseases have vaccination options?
4. What is the veterinarian recommended protocol for first time vaccination (is it different for young, old, lactating, etc. animals?)
5. Are there annual or more frequent booster vaccinations required?
6. Are there differences in recommendations for an animal that travels to exhibitions or competitions?

Activity Introduction

You will be assigned to a team to develop a vaccination protocol for your farm. Consider the species of animals, the type of animals (breeding, exhibition etc.) and their location.

Vaccination Protocol Activity Steps

Use internet resources to develop a vaccination protocol.

Discussion Questions

1. What vaccines would you recommend?
2. When should they be given?
3. What type of vaccines should be used?
4. What costs should be included in your vaccination plan?

Activity C: Design a Vaccination Protocol - Student Handout

Initial Engagement Questions

1. What species of animals do you have on your farm?
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Activity C: Design a Vaccination Protocol - Student Handout

Initial Engagement Questions

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Activity C: Design a Vaccination Protocol - Student Handout

Discussion Questions

1. What vaccines would you recommend?
2. When should they be given?
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4. What costs should be included in your vaccination plan?

Activity C: Design a Vaccination Protocol - Student Handout

Discussion Questions

1. What vaccines would you recommend?
2. When should they be given?
3. What type of vaccines should be used?
4. What costs should be included in your vaccination plan?



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SCRUB: Science Creates Real Understanding of Biosecurity Instructor Guide

Module 4

Building a Biosecure Barn or Facility

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Instructor Notes:

Introduction

There are many factors to consider when building structures such as barns and other facilities. Concepts such as traffic patterns, placement in the barn, materials that are easy to clean, feeding order, layout as related to animal health and biosecurity are essential in the decision-making process. When you work in an existing facility it is important to evaluate the current conditions and make adjustments as appropriate in order to maintain a healthy environment for your animals. When purchasing a facility, you have the opportunity to design a facility that is ideal for the health and wellbeing of your animals. In this activity you will have the opportunity to create your ideal facility using proper biosecurity protocols.

Key Concepts

- What is biosecurity?
- Why should we be concerned with who is bringing what to our farm?
- What are common contaminants found around your barn? (manure, etc.)
- What are the different forms of disease transmission?
- What are possible mechanisms for potential contaminants to be brought to the farm?
- What are typical contaminants that can be found at any animal facility? (manure, saliva, nasal secretions, parasites).

Goals & Learning Objectives

1. To identify and manage biosecurity risks.
2. To identify and create strategies to prevent disease transmission.
3. To implement skills learned in the Disease Transfer Laboratory and Cleaning and Disinfecting while you design your own facility.
4. Recommend animal biosecurity measures to limit disease spread that accounts for the species, individual susceptibility, and disease types.

Setting the Scene

In Activity A, students will begin learning about common disease-causing agents (virus, bacteria, etc.), from their species of interest, methods of transmission, and potential risks to animals and humans. A list can be built from Appendix A – Common Animal Diseases.

Armed with this new knowledge, Activity B will have students apply that knowledge using critical thinking skills and deduction, while injecting their own creative solutions. They will choose a species and design facilities using best practice for creating healthy environments by identifying where manure, hay, shavings, feed, etc., will be stored at the facility.

Activity A: Methods of Disease Transmission

Activity Objective

Students will be able to identify different types of contaminants and methods of transmission between animals (and/or humans).

Total Time	Preparation: 30 minutes if scheduling guest speakers.	Difficulty Level	Suggested Group Size
Approximately 45 minutes to 1.5 hours	Active: 15 minutes Wait: 0 minutes	Easy	Class (or small groups)

Materials

- Internet access for youth/students
- A list of 5 to 10 different disease agents for youth to research transmission mechanisms (you can use Appendix A).
- AND/OR Local experts (veterinarians, public health officials, etc.) join the class for a discussion.

Activity Links

The Center for Food Security and Public Health - Animal Diseases

- <https://www.cfsph.iastate.edu/diseaseinfo/>

USDA Animal and Plant Health Inspection Service - Pests and Diseases

- <https://www.aphis.usda.gov/aphis/resources/pests-diseases>

Equine Disease Communication Center

- <https://www.equinediseasecc.org/>

Other Resources

WiscOnline Learning Module 1 – What is Biosecurity?

- <https://www.wisc-online.com/courses/1207/biosecurities/modules/what-is-biosecurity>

WiscOnline Learning Module 2 – Biosecurity: Routes of Infection and Means of Transportation

- <https://www.wisc-online.com/courses/1208/biosecurities/modules/biosecurity-routes-of-infection-and-means-of>

WiscOnline Learning Module 3 – Biosecurity Finding Sources of Disease Transmission Risk

- <https://www.wisc-online.com/courses/1209/biosecurities/modules/biosecurity-finding-sources-of-disease-transm>

Disease transmission workshop overview for instructor

- <https://youtu.be/IRVjIMHp5pc>

Setup/Preparation – approximately 30 minutes

1. Prepare a handout listing 5-10 different disease-causing agents that your students or youth will research.
2. Optional: Invite a local expert such as a public health official or a veterinarian as a resource for this lesson, prior arrangements need to be made.

Initial Engagement Questions

1. What is the definition of a contaminant?
(A contaminant is a substance that pollutes, spoils, or poisons something.)
2. Can you provide examples of contaminants you are familiar with?
(Answers will range in complexity based on the background of your students/youth, but some answers could be bacteria, virus, fungus, chemical, toxin, etc. to things such as manure, urine, infected animal, etc. Other things that could come up include insects in food sources, mold, etc.)
3. What are some reasons you should be concerned about contaminants in and around your barn?
(Animal health may be negatively impacted, humans may also be at risk, depending on the contaminant, etc.)
4. Can you identify some best practices to ensure a healthy environment for you and your animals where minimal contaminants exist?
(Establish a regular vaccination program for your animals. Keep chemicals, medical supplies, and feed areas separated and secure from animals. Have a regular and thorough cleaning/disinfecting protocol, limit exposure of animals to outside traffic (human, animal, vehicle, etc.), and have a place to quarantine new animals or existing ones returning home from an event.)

Methods of Disease Transmission Activity Introduction

In this activity students will learn what types of contaminants exist in the barn/facility environment. They will then conduct internet research to gain a better understanding and define relevant examples of common contaminants.

Activity A Steps - approximately 45 to 60 minutes

1. Provide students a list of contaminants to research.
2. Ask them to define if it is bacteria, virus, fungus, or other (toxin, manure, etc.)
3. Is this contaminant linked to a disease? What species can be affected?
4. Is it zoonotic? (What does zoonotic mean?)

Instructor Notes

1. We recommend having the students do research and then bring in the “knowledge” person to provide relevant examples to be used as real-life applications for the students.
2. Students can identify and present the one most meaningful take away they have after participating in the lesson. How will they apply this knowledge in real life? Can they relate it to something in their current or past experiences that this information may apply to?

Discussion Questions

1. In this activity you will use the initial engagement and activity questions to facilitate the discussion. Further discussion may be had based on the topics that arise as well as the age, knowledge, and experience of the students.

Activity B: Evaluating the Biosecurity of Facilities

Activity Objective

Students will be able to identify areas of concern for disease transmission in small or large facilities by analyzing building locations, traffic patterns, animal shared spaces, availability of quarantine space, locations of, and access to, feed, water, hay, shavings, bedding, and manure storage, etc.

Total Time	Preparation: 30 minutes Active: 60+ minutes Wait: 0 minutes	Difficulty Level	Suggested Group Size
Approximately 90 minutes Could be a multi-day project depending on level of difficulty and engagement.		Medium to advanced	Class, small groups, or individual

Materials

Items to purchase or provide

- Facility printouts from binder/online resource
- For hands-on application*
- Glue or tape
 - Scissors
 - Colored pencils/crayons/markers/expo markers
 - Butcher paper (cut to 11"x17" for each facility) or white board

For computer generated application

- Use desired programs (e.g. Prezi, Powerpoint, etc.)
- Internet access

Activity Links

Barn Smarts for Biosecurity: Tips for Keeping Your Horse Safe and Healthy

- <https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1709-2020.pdf>

Barn Smarts for Biosecurity: Tips for Keeping Your Horse Safe and Healthy - Poster

- <https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/horse-biosecurity-poster-english.pdf>

Opciones Inteligentes para la Bioseguridad en el Establo Cuide la Salud de Sus Caballos

- <https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/horse-biosecurity-poster-spanish.pdf>

Tools for Promoting Biosecurity in Vermont's Equine Community

- <https://extension.arizona.edu/sites/extension.arizona.edu/files/data/biosecurity-tools-equine-vermont.pdf>

Equine Disease Communication Center

- <https://www.equinediseasecc.org/>

Healthy Farms Healthy Agriculture - Livestock General Biosecurity Guidelines

- <https://www.healthyagriculture.org/livestock/>

Setup/Preparation – approximately 30 minutes

1. Handouts of facilities need to be chosen and copied prior to activity.
2. For tabletop activities, cut butcher paper to a minimum of “11x17” to use the facility templates provided. Larger “farm area” is recommended, especially in the case of large farms and/or multiple species.
3. Scissors, glue/tape, and colored pencils/crayons/markers need to be accessible for student use.
4. Computers and internet accessibility for students choosing to participate using the computer or for virtual participants.

Initial Engagement Questions

1. When you take your animal to a fair/show, what are concerns that you may have regarding your animal’s health?
(possible answers: direct or indirect exposure to sick animals, e.g. nose-to-nose vs contaminated shared water/tools/equipment, respectively)
2. What are some signs that you might see in a sick animal?
(possible answers: use visual/visible rather than “measurable” cues, such as animal not eating, snotty nose, lethargic, away from herd, etc., as opposed to high temperature.)
3. How would you prevent your animal from coming into contact with any sick animals?
(possible answers: no shared tools, water sources, equipment, no nose-to-nose contact, separation between your stalls/pens and others, etc.)
4. What are some other situations/scenarios where you might be concerned about a healthy animal getting exposed to sick animals?
(possible answers: sales animals sharing pens, bringing a new animal home to your healthy animals, shared water troughs, etc.)

Activity Introduction

There are many factors to consider when building structures such as barns and other facilities. Concepts such as traffic patterns, placement in the barn, construction materials, feeding order, layout as related to animal health and biosecurity are essential in the decision-making process. When you work in an existing facility it is important to evaluate the current conditions and make adjustments as appropriate in order to maintain a healthy environment for your animals. When purchasing a facility, you have the opportunity to design a facility that is ideal for the health and wellbeing of your animals. In this activity you will have the opportunity to create your ideal facility using proper biosecurity protocols.

Activity B Steps - approximately 60+ minutes

1. Using the list provided, discuss different ways of direct and indirect transfer that can occur at an animal facility. This should include all aspects from animal-to-animal contact, exposure to manure via stalls/pens, equipment, humans, or travel paths, outside vehicle traffic patterns, barn setups, etc.
2. Each student/group chooses a facility to design.
3. Using either the handouts or accessible internet students will plan the locations of barns, roadways, and other necessary building/storage areas etc.
4. In this exercise, students will choose how/where to put roadways, traffic patterns, and directions of people/animals/vehicles. The goal is to minimize cross contamination, excessive traveling of outside traffic (feed, manure, delivery, etc.) in and around the facilities. For example, consider having a small

“loop” that allows feed/delivery/milk/etc. trucks to come in, do their pick up/drop off, and leave without entering animal areas. Placement of doors, buildings, and storage areas need to be taken into consideration.

5. For hands-on application: Have the students cut out the various facility pieces that will be used and glue them to their land (butcher paper). Alternatively, they may be taped to a white board. At a minimum, include 1 barn, feed storage, manure storage, clean bedding, and guest parking. Students should not feel limited by the pieces included and may draw in any facility structures or alternative barn layouts if they need them for their facility.
6. After laying out the facility and barns, students will draw in the barn entrances (based on how they structure the inside stalls/pens/storage) in green, property fences in red, and roadways in black with biosecurity concepts in mind.
7. Now, using different colors, draw the paths that will be taken to feed animals, clean pens/stalls, deliver feed, remove manure, and walking paths guests will use around the property and through the barn.

Instructor Notes

1. Please familiarize yourself with the handouts and additional resources prior to the lesson.
2. Also, review Activity A to ensure that the proper principles of contamination are integrated into the discussion for Activity B.
3. The first link in the link section provides a basic overview of biosecurity with good visuals to help illustrate concepts.
4. Refer to Instructor Notes example for a “good” and “bad” example.

Instructor Options

1. Depending on the age and experience of the youth or students, you can change the rigor of content and expectations of the students. For inexperienced youth, you may have them design a facility for one species.
2. An older or more experienced group could design a facility for multiple species.
3. For further engagement have students or groups present their facilities to the class and explain their logic and reasoning behind facilities design and placement.
4. If there are pieces that are unique to your geographical area or farm/fair facilities, these can be added in as needed. The supplemental resources serve as a base level guideline for common farm facility set ups.

Taking it to the Farm

If students have access/desire to go, this laboratory can be set up to do some checking of different facility setups on a real farm.

Discussion Questions

1. Examine the completed facility and the paths of travel. How biosecure is your property?
2. Are there any items in your layout that could be moved to improve biosecurity?

3. What are common practices that are highly susceptible to contamination?
(Many people use the same wheeled vehicle (gators, 4 wheelers, etc.) to carry feed to their animals, as well as clean the stall/pen without disinfecting. Best practice is to use separate equipment. Throwing hay on the floor of a stall/pen that has manure/urine is another common practice. Have students think about practices they have either done or seen done at home or at the fair/show)
4. What are some changes you can make immediately to improve the health and well-being of both yourself and your animal(s) in real-life?
(These may need to be handled in a "sensitive" manner so that students can speak up about practices that are "bad" without drawing attention to individual poor management or practices. Focus on framing the problem as a way to develop a solution for the benefit of the whole and use best practices to guide the discussion.)
5. How can you help educate others on the importance of biosecurity?
(This might vary from changing their set up or behaviors at their own facilities, hanging up the biosecurity poster in their barn, or presenting their biosecurity knowledge to a new or younger group.)
6. Can you identify areas and provide proactive solutions for/at your own barn as well as public facilities that are susceptible to contamination based on what you have learned?
(Establish a place to quarantine new animals, use separate tools for sick and healthy animals, change storage areas to decrease outside traffic (see instructor example), change cleaning procedures-clean and disinfect more often, control human and vehicle traffic on your facility, develop/increase your awareness of the risks of contamination sources, etc.)

For Further Investigation

County Fair Exercise

The county fair has asked you to help improve their biosecurity. Lead a class discussion on what should be taken into consideration. This may include what students have observed in the past (both correct and incorrect) and what changes they would recommend.

If desired use the various livestock facility pieces to design a county fair layout in the same manner as above.

Possible County Fair Items to Consider:

(This list is not complete, and you can use your own fair experience to create other needed items)

- Barns for various species
 - Are barns separated by species or are they multi-species?
- People traffic pattern (public and animal)
- Common water troughs/feed troughs
- Large manure dumping spot
- Common wash stalls/stanchions/racks
- Hay/Feed/Shavings
 - Is it brought in or is it required to be purchased on site?
 - Where is it stored?
- Trailer parking
- Bleachers/stands/ public viewing areas
- Show tables for small stock/animals

Module 4 - Building a Biosecure Barn

- Show offices
- Arenas
- Restrooms
- Vendors
- Food concessions

More Advanced: Secure Food Supply Exercise

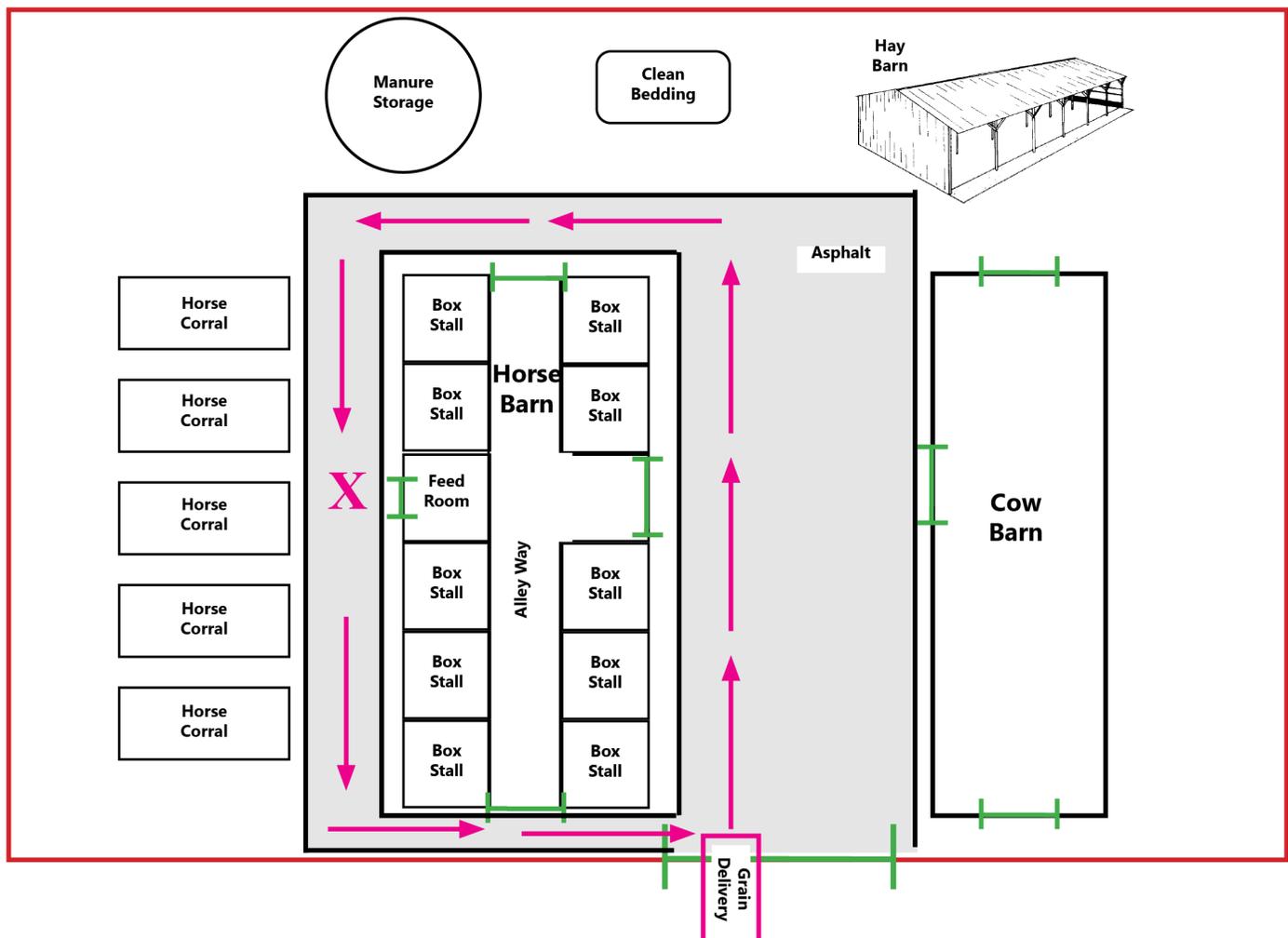
Using the information provided at <https://www.cfsph.iastate.edu/Secure-Food-Supply/>, adapt the existing creations to create a voluntary Secure Food Supply plan for their animals.

Instructor Notes and Examples

This example is provided for your personal use to understand and then help convey to students how traffic patterns or behaviors can be changed to improve biosecurity at an existing facility.

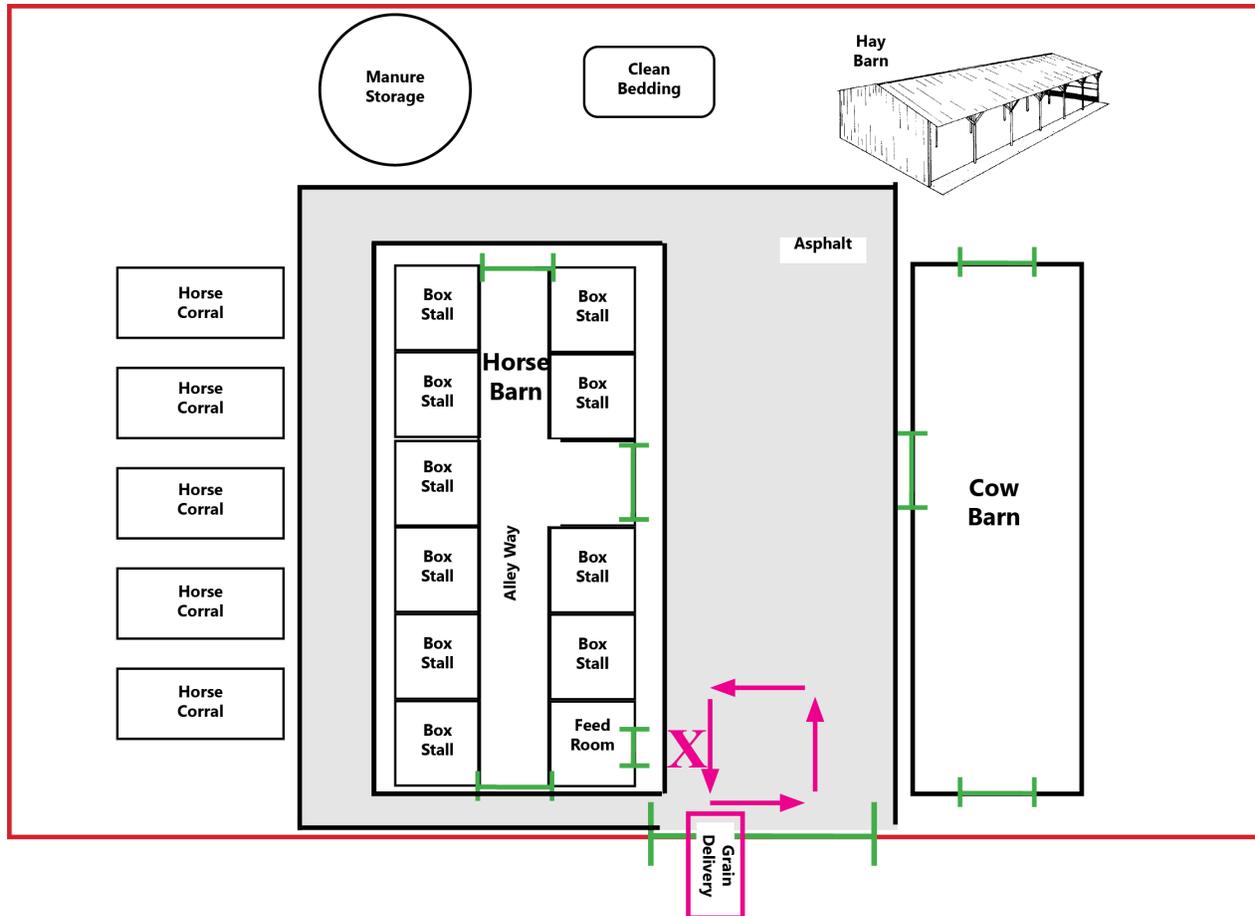
Bad example (from a real situation):

Feed delivery truck must pass through entire farm, cross manure, feed, and horse traffic paths to deliver feed to the current feed room location.



Better option:

Change location of the feed room to minimize the feed delivery truck “on-farm” traffic pattern.



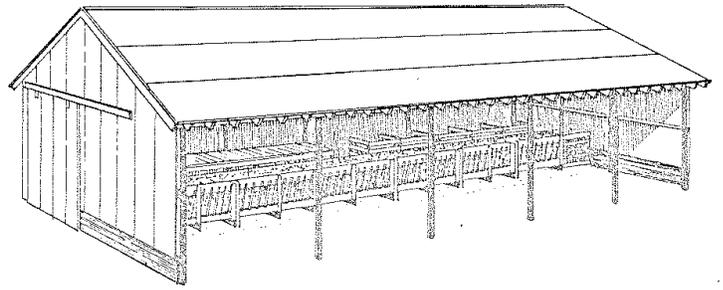
Facility Options

Choose from the livestock facility layouts on the next few pages for students to use to build their facilities. Make single sided copies of the chosen layout(s) for each individual or group. Depending on class setup all students and/or groups can do the same type of facility or instructor may choose to have students and/or groups do different options depending on interest.

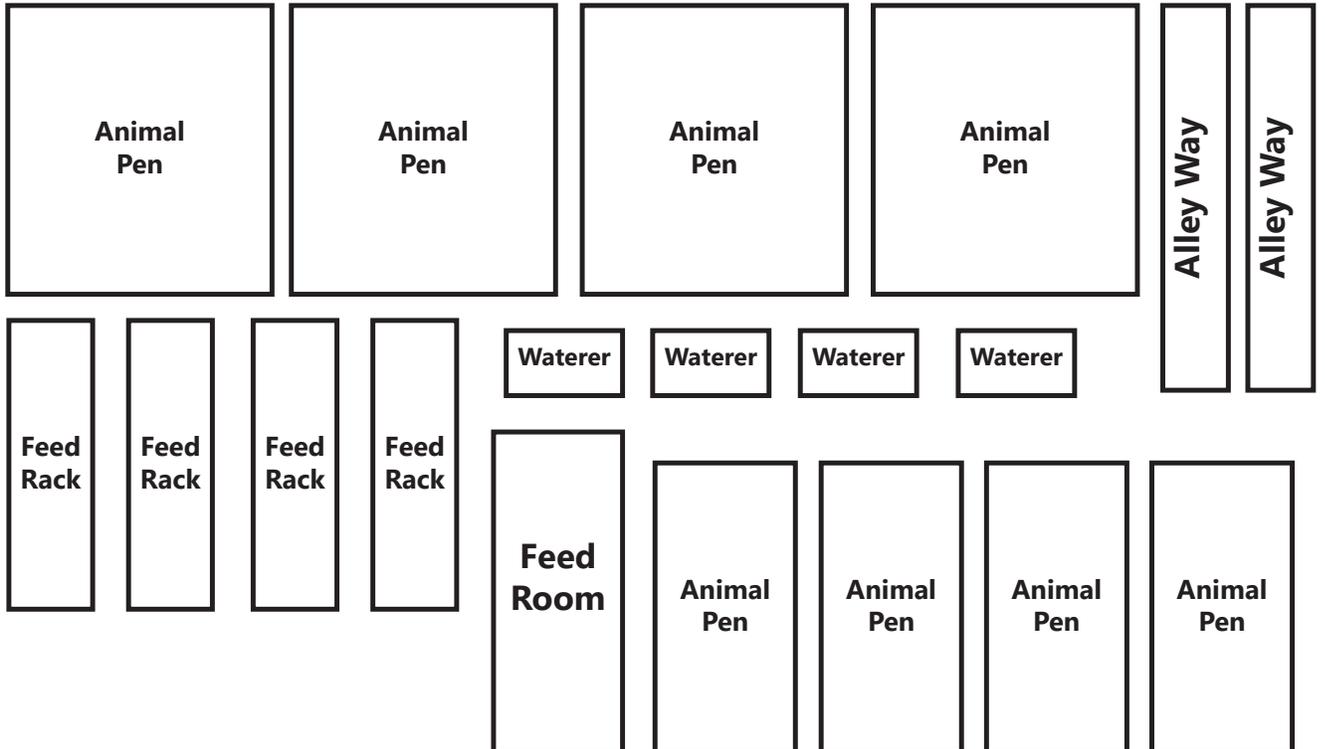
Facility options include:

- Horse
- Sheep and/or Goat
- Swine
- Dairy
- Fairgrounds (for this layout also copy the animal facilities that will be needed at your fair)

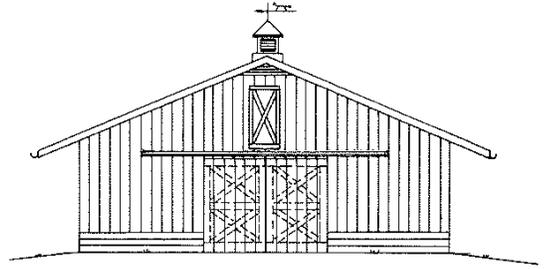
Sheep Facility



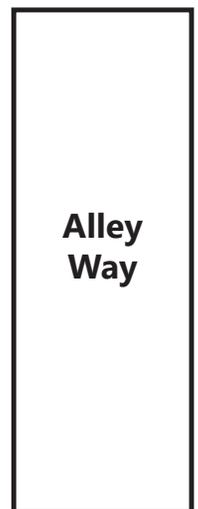
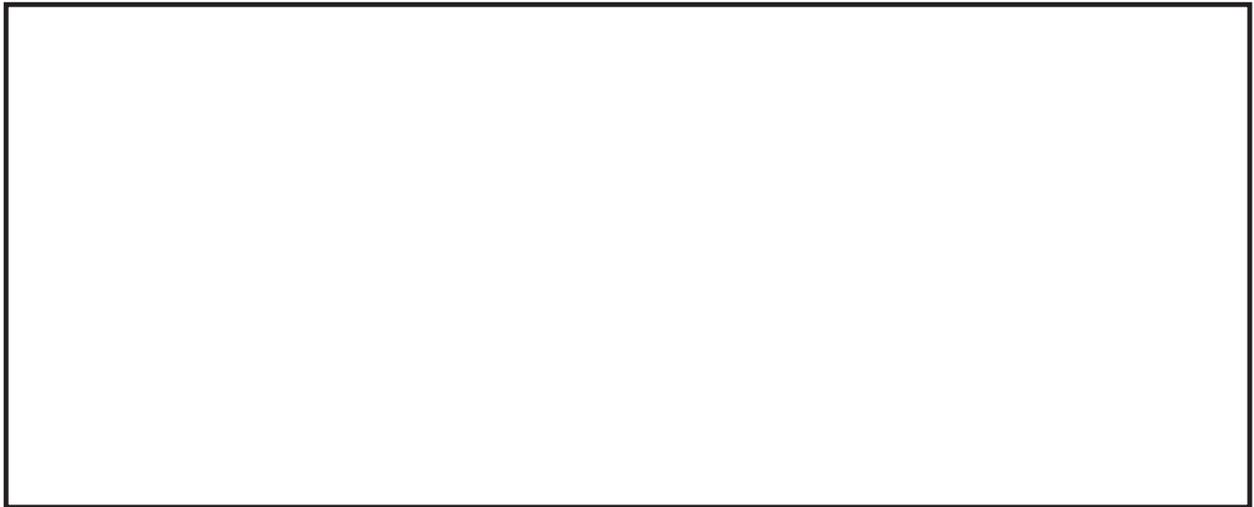
Barn



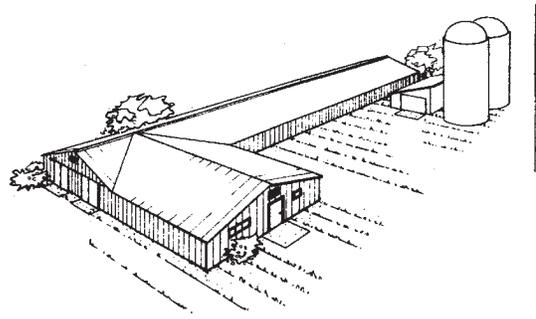
Horse Facility



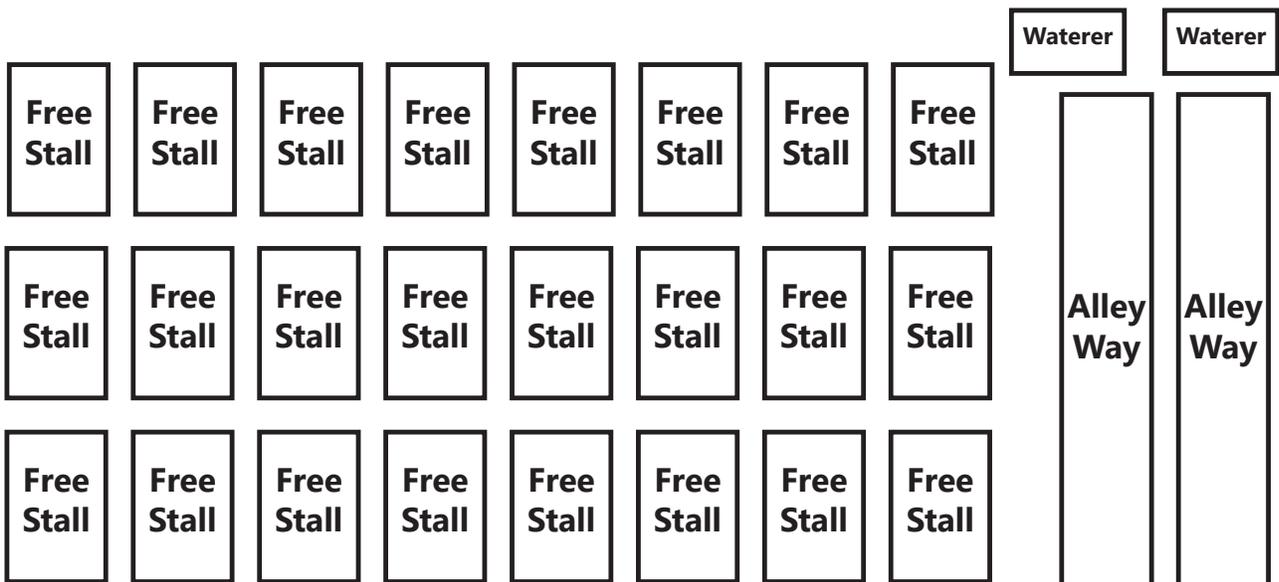
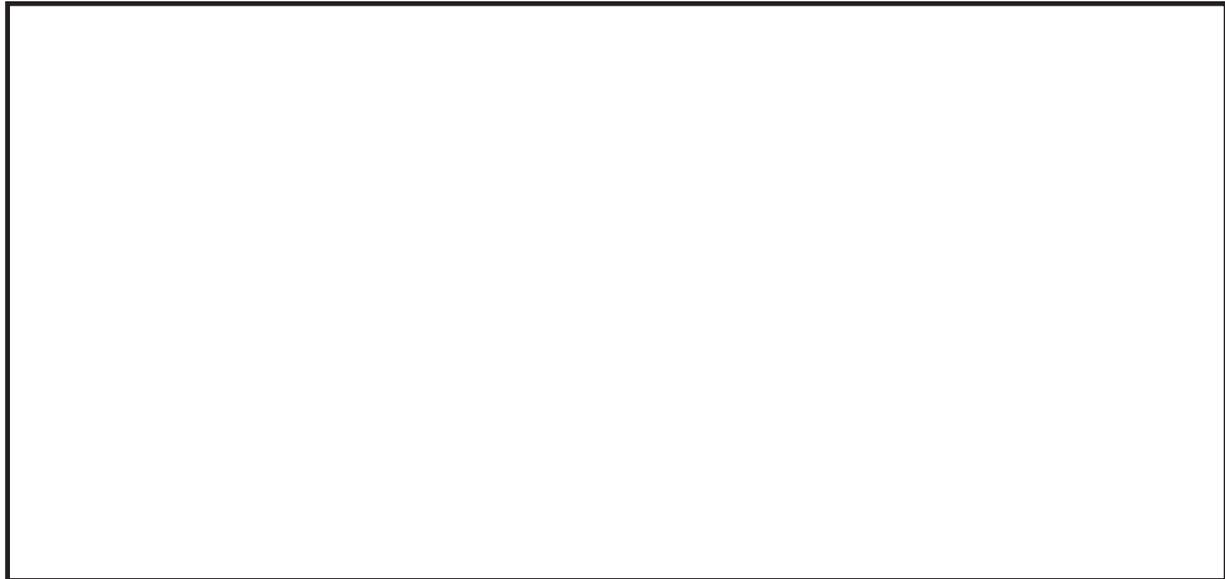
Barn



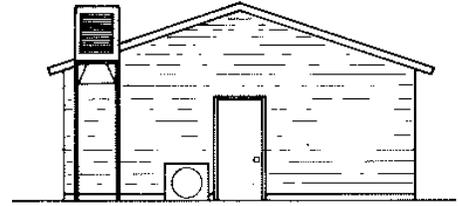
Dairy Facility



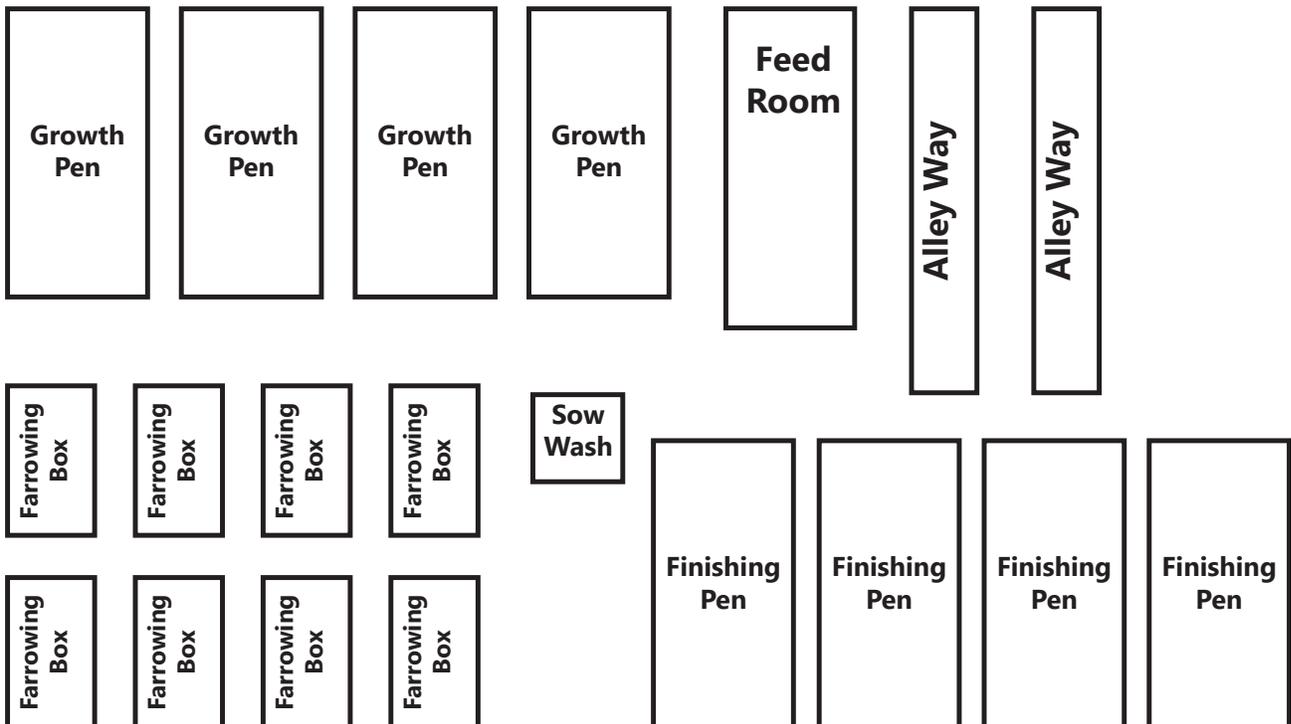
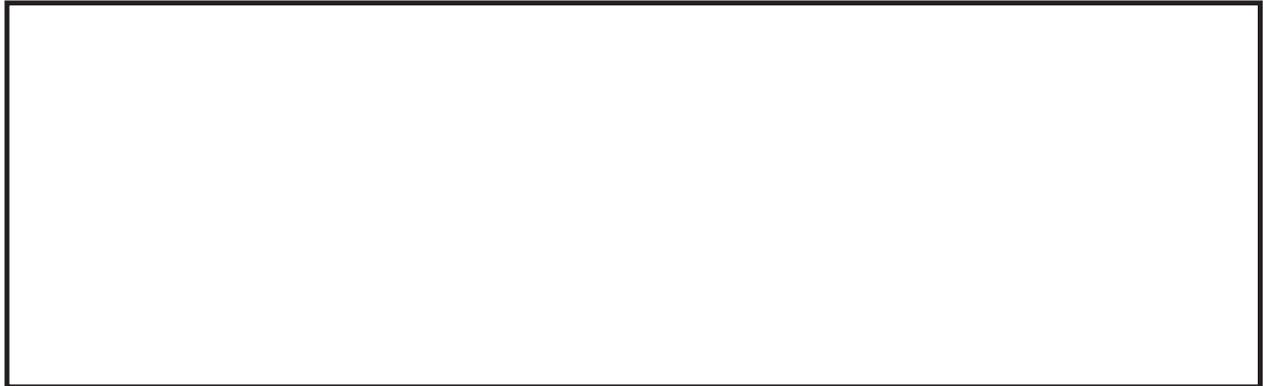
Barn



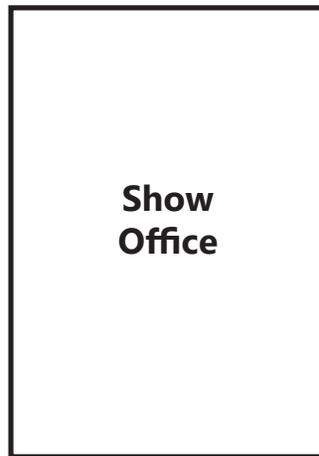
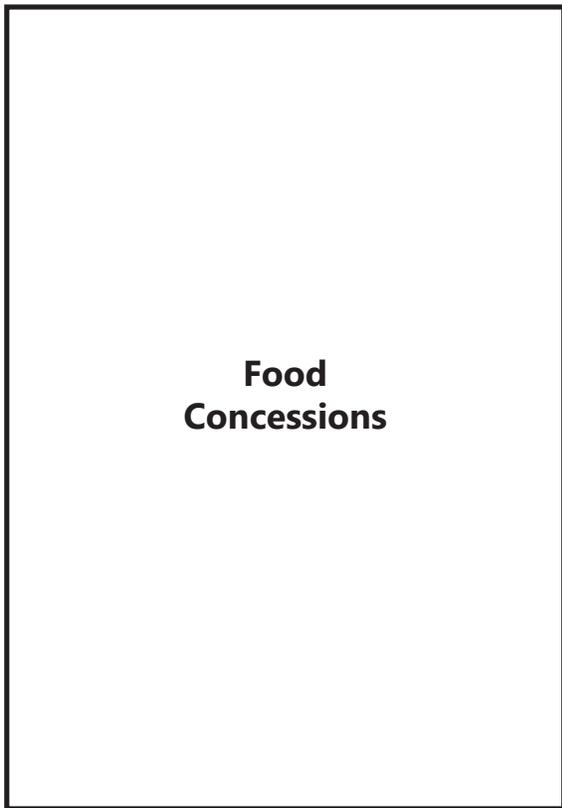
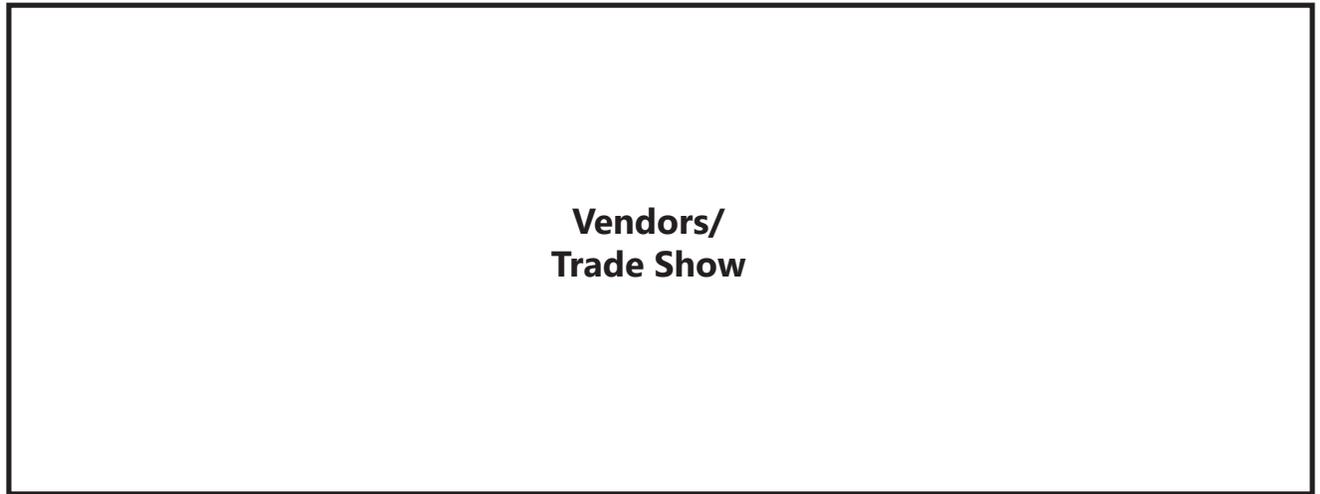
Swine Facility



Barn



Fairgrounds



SCRUB: Science Creates Real Understanding of Biosecurity

Student Guide

Module 4 Summary

Building a Biosecure Barn or Facility

Introduction

There are many factors to consider when building structures such as barns and other facilities. Concepts such as traffic patterns, placement in the barn, materials that are easy to clean, feeding order, layout as related to animal health and biosecurity are essential in the decision-making process. When you work in an existing facility it is important to evaluate the current conditions and make adjustments as appropriate in order to maintain a healthy environment for your animals. When purchasing a facility, you have the opportunity to design a facility that is ideal for the health and wellbeing of your animals. In this activity you will have the opportunity to create your ideal facility using proper biosecurity protocols.

Key Concepts

- What is biosecurity?
- Why should we be concerned with who is bringing what to our farm?
- What are common contaminants found around your barn?
- What are the different forms of disease transmission?
- What are possible mechanisms for potential contaminants to be brought to the farm?
- What are typical contaminants that can be found at any animal facility?

Goals & Learning Objectives

1. To identify and manage biosecurity risks.
2. To identify and create strategies to prevent disease transmission.
3. To implement skills learned in the Disease Transfer Laboratory and Cleaning and Disinfecting while you design your own facility.
4. Recommend animal biosecurity measures to limit disease spread that accounts for the species, individual susceptibility, and disease types.

Activity A: Methods of Disease Transmission - Student Summary

Activity Objective

Students will be able to identify different types of contaminants and methods of transmission between animals (and/or humans).

Initial Questions

1. What is the definition of a contaminant?
2. Can you provide examples of contaminants you are familiar with?
3. What are some reasons you should be concerned about contaminants in and around your barn?
4. Can you identify some best practices to ensure a healthy environment for you and your animals where minimal contaminants exist?

Activity Introduction

In this activity you will learn what types of contaminants exist in the barn/facility environment. You will then conduct internet research to gain a better understanding and define relevant examples of common contaminants.

Methods of Disease Transmission Activity Steps

1. A list of contaminants to research will be provided by your instructor.
2. Define if each contaminant is a bacteria, virus, fungus, or other (toxin, manure, etc.).
3. Is this contaminant linked to a disease? What species can be affected?
4. Is it zoonotic? (What does zoonotic mean?)

Activity A: Methods of Disease Transmission - Student Handout

Initial Questions

1. What is the definition of a contaminant?
2. Can you provide examples of contaminants you are familiar with?
3. What are some reasons you should be concerned about contaminants in and around your barn?
4. Can you identify some best practices to ensure a healthy environment for you and your animals where minimal contaminants exist?

Activity A: Methods of Disease Transmission - Student Handout

Initial Questions

1. What is the definition of a contaminant?
2. Can you provide examples of contaminants you are familiar with?
3. What are some reasons you should be concerned about contaminants in and around your barn?
4. Can you identify some best practices to ensure a healthy environment for you and your animals where minimal contaminants exist?

Activity B: Evaluating the Biosecurity of Facilities - Student Summary

Activity Objective

Students will be able to identify areas of concern for disease transmission in small or large facilities by analyzing building locations, traffic patterns, animal shared spaces, availability of quarantine space (or not), locations and access to feed, water, hay, shavings, bedding, and manure storage, etc.

Initial Questions

1. When you take your animal to a fair/show, what are concerns that you may have regarding your animal's health?
2. What are some signs that you might see in a sick animal?
3. How would you prevent your animal from coming into contact with any sick animals?
4. What are some other situations/scenarios where you might be concerned about a healthy animal getting exposed to sick animals?

Activity Introduction

There are many factors to consider when building structures such as barns and other facilities. Concepts such as traffic patterns, placement in the barn, construction materials, feeding order, layout as related to animal health and biosecurity are essential in the decision-making process. When you work in an existing facility it is important to evaluate the current conditions and make adjustments as appropriate in order to maintain a healthy environment for your animals. When purchasing a facility, you have the opportunity to design a facility that is ideal for the health and wellbeing of your animals. In this activity you will have the opportunity to create your ideal facility using proper biosecurity protocols.

Evaluating the Biosecurity of Facilities Activity Steps

1. Each student/group chooses a facility to design.
2. Using either the handouts provided by the instructor or accessible internet students will plan the locations of barns, roadways, and other necessary building/storage areas etc.
3. In this exercise, students will choose how/where to put roadways, traffic patterns, and directions of people/animals/vehicles. The goal is to minimize cross contamination, excessive traveling of outside traffic (feed, manure, delivery, etc.) in and around the facilities. For example, consider having a small "loop" that allows feed/delivery/milk/etc. trucks to come in, do their pick up/drop off, and leave without entering animal areas. Placement of doors, buildings, and storage areas need to be taken into consideration.

4. For hands-on application: Have the students cut out the various facility pieces that will be used and glue them to their land (butcher paper). Alternatively, they may be taped to a white board. At a minimum, include 1 barn, feed storage, manure storage, clean bedding, and guest parking. Students should not feel limited by the pieces included and may draw in any facility structures or alternative barn layouts if they need them for their facility.
5. After laying out the facility and barns, students will draw in the barn entrances (based on how they structure the inside stalls/pens/storage) in green, property fences in red, and roadways in black with biosecurity concepts in mind.
6. Now, using different colors, draw the paths that will be taken to feed animals, clean pens/stalls, deliver feed, remove manure, and walking paths guests will use around the property and through the barn.

Discussion Questions

1. Examine the completed facility and the paths of travel. How biosecure is your property?
2. Are there any items in your layout that could be moved to improve biosecurity?
3. What are common practices that are highly susceptible to contamination?
4. What are some changes you can make immediately to improve the health and well-being of both yourself and your animal(s) in real-life?
5. How can you help educate others on the importance of biosecurity?
6. Can you identify areas and provide proactive solutions for/at your own barn as well as public facilities that are susceptible to contamination based on what you have learned?

Activity B: Evaluating the Biosecurity of Facilities - Student Handout

Initial Questions

1. When you take your animal to a fair/show, what are concerns that you may have regarding your animal's health?
2. What are some signs that you might see in a sick animal?
3. How would you prevent your animal from coming into contact with any sick animals?
4. What are some other situations/scenarios where you might be concerned about a healthy animal getting exposed to sick animals?

Activity B: Evaluating the Biosecurity of Facilities - Student Handout

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1. When you take your animal to a fair/show, what are concerns that you may have regarding your animal's health?
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Activity B: Evaluating the Biosecurity of Facilities - Student Handout

Discussion Questions

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6. Can you identify areas and provide proactive solutions for/at your own barn as well as public facilities that are susceptible to contamination based on what you have learned?

Activity B: Evaluating the Biosecurity of Facilities - Student Handout

Discussion Questions

1. Examine the completed facility and the paths of travel. How biosecure is your property?
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4. What are some changes you can make immediately to improve the health and well-being of both yourself and your animal(s) in real-life?
5. How can you help educate others on the importance of biosecurity?
6. Can you identify areas and provide proactive solutions for/at your own barn as well as public facilities that are susceptible to contamination based on what you have learned?

Instructor Notes:



HealthyFarms
HealthyAgriculture



THE UNIVERSITY OF ARIZONA
Cooperative Extension



OKLAHOMA COOPERATIVE
EXTENSION SERVICE

SCRUB: Science Creates Real Understanding of Biosecurity Instructor Guide

Appendices

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Instructor Notes:

Appendix A – Example Animal Diseases

Animal	Disease	Vaccine?	Symptoms	Transmission routes	Zoonotic?
Cattle, Goats	Tuberculosis (TB)	N	Some asymptomatic; weight loss, weakness, fever, coughing	Direct contact; contaminated feed, water, milk, feces, and mucus	Y
Cattle, Horses, Swine, Sheep, Goats	Brucellosis	Y	Abortion, less milk production, lower fertility, retained afterbirth, weak calves	Direct contact; contaminated environment, urine, milk, blood, semen, or birth tissues and fluids	Y
Cattle	Bovine spongiform encephalopathy (BSE)	N	Change in temperament, abnormal posture, incoordination, loss of body condition, death	Not fully known – prion related, consumption of prion containing material	Y
Cattle, Sheep	Bluetongue	Y	Edema, congestion, hemorrhage, inflammation, necrosis of infected tissue; listless, lameness, depression, abnormal wool growth	Biting midges	N
Cattle	Blackleg	Y	Sudden death, lameness, swollen muscles, depression, fever, inability to stand	Soil ingestion or contamination of open wounds	N
Cattle	Calf enteritis (scours)	Y – through dam's milk	Diarrhea, sudden death, weight loss, state of shock	Contaminated environment (barn/buckets)	N
Cattle	Anaplasmosis	Y	Fever, anemia, weight loss, breathlessness, jaundice, incoordination, abortion, death	Tick bites	Y
Cattle	Bovine leukemia	N	Most asymptomatic, less than 5% develop lymphosarcoma – lymph node enlargement, labored breathing, bloat, increased heart rate, weight loss, lowered milk production, brisket edema, fever, loss of appetite, infertility	Blood to blood	N
Cattle, Swine, Sheep, Goats	Foot-and-mouth disease	Y	Fever, excessive salivation, lameness, blisters, loss of appetite, abortions, low milk production, possibly death	Infected saliva, urine, excrement, and even breathing; contaminated feed, water, and environment	N

Appendix A - Example Animal Diseases

Animal	Disease	Vaccine?	Symptoms	Transmission routes	Zoonotic?
Cattle, Sheep, Goats	Foot rot	Y – effective 60-80% of the time	Lameness, loss of appetite, fever, depression, possibly death	Environmental contamination, broken skin	N
Cattle	Keratoconjunctivitis (pinkeye)	Y	Pinkish colored eye, clouded cornea, tears, may result in blindness, ocular discharge	Insects, direct contact, dust	Y – some strains
Cattle	Trichomoniasis	N	Early embryonic death, infertility, abortion, irregular cycles, uterine infection, discharge from reproductive tract	Venerally under natural breeding conditions, or with infected semen when using artificial insemination	N
Cattle, Horses, Swine (occasionally sheep and goats)	Vesicular stomatitis (VS)	N	Blister-like lesions in the mouth, on the nose, on hooves, and on teats; lameness; loss of appetite; fever; drooling	Insects (flies), direct contact	Y – but rare
Cattle, Sheep, Goats	Johne’s disease	N	Weight loss and diarrhea with normal appetite, intermandibular edema	Contaminated environment, infected milk, prenatal infection	Y
Cattle, Sheep, Goats	Anthrax	Y	Sudden death; blood oozing from mouth, nose, and anus	Oral ingestion of contaminated soil, inhalation of contaminated dust, biting flies, tick bites, re-used needles from infected animal, direct contact	Y
Cattle	Cryptosporidiosis	N	Diarrhea	Infected feed and water	Y
Cattle, Horses, Sheep, Goats	Dermatophilosis (rain rot)	N	Thick scabs, hair loss, sore skin	Direct contact, biting insects, wet conditions	Y – but rare
Cattle	Colibacillosis (caused by <i>Escherichia coli</i>)	N	Bloody diarrhea in calves; asymptomatic in adult cattle	Contaminated feed and water	Y
Cattle, Horses, Swine, Sheep, Goats	Leptospirosis	Y	Abortion, weak offspring, may be asymptomatic, anemia, jaundice	Contaminated urine, water, and soil	Y

Animal	Disease	Vaccine?	Symptoms	Transmission routes	Zoonotic?
Cattle, Sheep, Goats	Listeriosis	N	Circling, incoordination, inability to chew and swallow, abortion, facial paralysis, depression, excessive salivation, disorientation	Contaminated silage, soil, urine, feces, nasal discharge, and milk	Y
Cattle	Bovine respiratory disease (shipping fever)	Y	Fever, depression, drooping ears, nasal discharge, watery eyes, loss of appetite, diarrhea, weight loss, difficulty breathing, coughing, possibly death	Stress – extreme temperatures, moving cattle to feedlots, hunger, fright, rough handling – allow bacteria to attack respiratory system	N
Cattle	Pseudocowpox (milker's nodule)	N	Small raised sores and scabs on teats and udders	Direct contact from cattle and milking equipment	Y
Cattle, Sheep, Goats	Q fever	Y – but not in America	Abortion, lesions, anorexia	Contaminated reproductive fluids and tissues, milk, urine, and feces	Y
Cattle, Horses, Swine, Sheep, Goats	Rabies	Y	Behavior changes, excessive vocalization, difficulty swallowing, drooling, paralysis, death	Infected saliva, open wounds, and mucous membranes	Y
Cattle, Horses, Swine, Sheep, Goats, Poultry	Ringworm	N	Round, scaly patches of hairless skin	Direct contact	Y
Cattle	Salmonellosis	N	Diarrhea, dehydration	Contaminated feed, water, and environment	Y
Cattle, Sheep, Goats	Enterotoxemia Type D (overeating disease)	Y	Lameness, bloody diarrhea, bloat, possibly death	High concentrate diet	N
Horses	Equine encephalitis (Eastern, EEE; Western, WEE; Venezuelan, VEE)	Y	Fever, depression, behavior changes, circling, muscle twitches, impaired vision, inability to swallow, paralysis, convulsions, death	Infected mosquitoes	Y

Animal	Disease	Vaccine?	Symptoms	Transmission routes	Zoonotic?
Horses	Equine herpesvirus (EHV-1 -3 and -4)	Y	Fever, difficulty urinating, nasal discharge, depression, head tilt, stumbling, weakness in hind limbs, unable to stand	EHV-1 and -4: nose to nose contact, contaminated equipment, respiratory secretions; EHV-3: venereal transmission, contaminated breeding equipment	N
Horses	Equine infectious anemia (EIA or swamp fever)	N – Coggins test	Jaundice, rapid breathing, rapid heart rate, swelling of limbs, bleeding from the nose, bloody feces	Blood feeding flies, re-used needles from infected horses, blood transfusions, contaminated medical equipment, in utero	N
Horses	Equine viral arteritis (EVA)	Y	Fever, depression, anorexia, limb/mammary/scrotum edema, hives, conjunctivitis, abortions, stillbirths, decreased fertility	Respiratory secretions, natural and artificial breeding, semen	N
Horses	West Nile virus (WNV)	Y	Fever, incoordination, hind limb weakness, depression, muscle tremors, inability to swallow, excessive sweating, behavior changes, inability to stand, head pressing	Infected mosquitoes	Y
Horses	Equine influenza	Y	Fever, coughing, dry hacking, depression, muscle weakness, nasal discharge, loss of appetite	Direct contact, respiratory secretions; indirect spread from infected clothing, equipment, water buckets, brushes, etc.	N
Horses	Strangles (distemper)	Y	Nasal discharge, swollen throat glands, pus drainage	Respiratory discharge; indirect from water buckets, tack, feed, clothing, equipment, and people	Y – reported but not common
Horses	Equine protozoal myeloencephalitis (EPM)	N	Incoordination, muscle weakness, lameness	Contaminated feed	N
Horses	Rotavirus A (for foals)	Y – through dam’s milk	Severe diarrhea, possible death	Contact with contaminated objects, animals, or people	Y

Animal	Disease	Vaccine?	Symptoms	Transmission routes	Zoonotic?
Cattle, Horses	Pigeon fever (dryland strangles)	N	Pus drainage, deep sores, or abscesses along midline; swollen chest	Open wounds, broken skin, mucous membranes, flies	Y
Cattle, Horses	Piroplasmiasis	N	Weakness, loss of appetite, weight loss, fever, anemia, jaundice, swollen abdomen, reddish urine, labored breathing, colic, sudden death	Tick bites, re-used needles from infected animals, contaminated medical equipment, in utero	N
Swine	Classical swine fever	Y – require USDA approval to use	Fever, huddling, constipation, diarrhea, hemorrhages, incoordination, weakness, abortion, stillbirths	Mucous membranes, skin abrasions, contaminated environment and feed	N
Swine	Edema disease	Y	Ataxia, anorexia, depression, death, abnormal squeals	Contaminated environment	N
Swine	Swine dysentery (bloody dysentery)	N	Diarrhea, excess mucus secretions, sunken eyes, depression, erratic appetite, sudden death	Direct contact, infected sows can give it to piglets in utero, possibly infected mice	N
Swine	Mycoplasma	Y	Arthritis, pneumonia, coughing, decreased growth	Direct contact, coughing	N
Swine	Porcine pleuropneumonia	N	Death, nasal discharge, fever, coughing, reduced growth rates	Direct contact, coughing, in utero	N
Cattle, Swine, Sheep, Goats	Pseudorabies (PRV)	N	Abortions, stillbirths, incoordination, coughing, sneezing, fever, mummified piglets	Direct contact with mouth or nose, contaminated breeding equipment	N
Swine	Porcine parvovirus (PPV)	Y – sows	Abortions, stillbirths, infertility	Nasal discharge, from coughing or sneezing	N
Swine	African swine fever (ASF)	N	High fever, decreased appetite, weakness, death, blotchy lesions, diarrhea, abortion, nasal discharge, coughing, difficulty breathing	Contaminated feed and environment	N
Swine	Influenza A virus (IAV- S)	Y	Fever, coughing, loss of appetite, sneezing, nasal discharge, difficulty breathing	Close contact, coughing, sneezing, contaminated objects	Y

Appendix A - Example Animal Diseases

Animal	Disease	Vaccine?	Symptoms	Transmission routes	Zoonotic?
Swine	Actinobacillus pleuropneumonia (APP)	Y	Sudden death, labored breathing, fever, depression, reluctance to move	Direct contact, coughing, in utero	N
Swine	Porcine epidemic diarrhea virus (PEDv)	N	Diarrhea, dehydration, death	Direct contact with infected swine, feed, equipment, or people	N
Swine	Anemia	Y	Pale skin, dry mucous membranes, labored breathing, rapid breathing, uneven growth	Iron deficiency, prevented through injection of iron dextran	N
Swine	Exudative epidermitis (greasy pig disease)	Y – prepared on a per farm basis	Brown debris on the skin of head and neck, dehydration, film of grease over the skin	Direct contact	N
Swine	<i>Haemophilus parasuis</i> (Glasser’s disease)	Y	Fever, panting, coughing, convulsions, tremors, sudden death, incoordination, swollen joints, depression	Direct contact, air droplets	N
Swine	Porcine reproductive and respiratory syndrome (PRRS)	Y	Abortion, stillbirths, mummified fetuses, poor conception rates	Close contact	Y – only if direct contact with blood
Swine	<i>Streptococcus suis</i>	Y	Nasal discharge, seizures, swollen joints and limbs, breathing difficulty	Picked up during farrowing	Y
Sheep, Goats	Enterotoxemia type C (bloody scours)	Y	Ulcers in small intestine, bloody diarrhea, possibly death	Contaminated environment (barn/buckets)	N
Sheep, Goats	Tetanus (lockjaw)	Y	Rigid, muscle spasms, death	Contamination through broken skin	Y
Sheep, Goats	Soremouth, orf (ontagious ecthyma) (soremouth)	Y	Scabs/blisters on lips, nose, udders, teats, and the junction of the hoof and skin; loss of body condition, decreased growth rates, death, mastitis	Broken skin; direct contact; contaminated feed, equipment, and bedding;	Y

Animal	Disease	Vaccine?	Symptoms	Transmission routes	Zoonotic?
Sheep, Goats	Pneumonia	N	Fever, painful cough, difficulty breathing, depression	Poor ventilation, dust, environment that irritates the lungs	Y
Sheep, Goats	Caseous lymphadenitis (CL)	Y – controversial	Abscesses in the lymph nodes and internal organs, weight loss, decreased wool growth, lowered milk production, reproductive problems, possible death, fever	Abscess, direct contact, contaminated equipment and environment	Y – potentially through raw milk
Sheep, Goats	Polioencephalomalacia (PEM)	N	Incoordination, weakness, tremors, blindness, depression, sudden death, muscle seizures	Thiamine deficiency	N
Goats	Caprine arthritis and encephalitis (CAE)	N	Swollen joints, pneumonia	Contaminated milk	N
Poultry	Virulent Newcastle disease (vND)	Y	Sudden death, sneezing, gasping for air, nasal discharge, coughing, diarrhea, decrease activity, swelling around the eyes and neck	Contaminated feces, egg crates, farm equipment, clothing, shoes, hands	N – from eating products Y – very rare from working with infected birds
Poultry	Avian influenza (AI)	Y – not for preventing infection in birds but reducing the risk of passing it to humans	Sudden death, lack of appetite, decreased egg production, nasal discharge, coughing, sneezing, incoordination, diarrhea; purple discoloration of legs, combs, and wattles; swelling of head, comb, eyelids, wattles, and hocks	Direct contact	Y – some subtypes
Poultry	Marek's disease	Y	Tumors, paralysis, pupil color change, irregular pupils	Contaminated dust, litter, and soil	N
Poultry	Infectious bronchitis	Y	Egg shell abnormalities, reduced growth	Damaged respiratory tract from dust	N
Poultry	Fowlpox	Y	Lesions in the mouth and trachea, death from suffocation	Contact between lesions and open wounds	N

Appendix A - Example Animal Diseases

Animal	Disease	Vaccine?	Symptoms	Transmission routes	Zoonotic?
Poultry	Fowl cholera (Pasteurellosis)	Y	Sudden death, loss of appetite, weight loss, lameness, lesions	Contaminated feces, water, soil, and equipment	Y-(in immune compromised individuals)
Poultry	Necrotic enteritis (rot gut)	N	Depression, death, reduced growth, lesions	Oral contact	N
Poultry	Fowl typhoid (Salmonellosis)	N	Listlessness, diarrhea, loss of appetite, anemic appearance	Infected hen to egg, chick-to-chick, infected houses and incubators	Y-rarely
Poultry – Chickens Only	Lymphoid leukosis	Y	Tumors, paralysis, pupil color change, irregular pupils	Contaminated feces or vaccines	N

Appendix B – Stories of Disease Transmission

Pigs

African Swine Fever (ASF)

September 3, 2018

A pig farmer in Estonia had to destroy all 7,000 of his pigs when there was an outbreak of African Swine Fever on one area of his farm. He had strict biosecurity protocols in place, so it is not known how his pigs became infected. The best idea was the virus was brought in on a truck that drove from an infected farm and was not properly washed before entering the facility. This outbreak of ASF is one of many that occurred in central and eastern Europe, beginning in January 2014 in Lithuania. Outbreaks then spread to Poland in February and Latvia and Estonia in June and September. Cases were also confirmed in the Czech Republic in June 2017. Outbreaks in Russia, Ukraine, and Moldova were also confirmed. Recently outbreaks have been confirmed in China, which is home to half the world's pig population.

The Guardian News Article

<https://www.theguardian.com/environment/2018/sep/03/its-not-if-its-when-the-deadly-pig-disease-spreading-around-the-world>

September 10, 2018

African Swine Fever continues to spread through China, in both domestic and wild pig populations. Veterinary authorities are working together from 12 countries to minimize the damage of ASF and hopefully prevent ASF from spreading further. Controlling the spread is the main goal, as there is no vaccine or cure for ASF. All infected animals are humanely euthanized. The virus will inevitably spread out of China and cause major animal and economic losses worldwide.

Science Magazine News Article

<https://www.sciencemag.org/news/2018/09/deadly-pig-disease-raging-china-bound-spread-other-asian-countries-experts-warn>

Porcine Epidemic Disease Virus (PEDv)

May 2013

In May of 2013, Porcine Epidemic Disease Virus (PEDv) was reported in 30 states, killing an estimated 10% of pigs in the U.S. This massively impacted the U.S. pork industry and it was predicted that in 2014, production losses from PEDv would be up by 7 percent. A study of 222 swine units in 4 states showed that 40.5% of the units had experienced PEDv. There were 40 sow units included in the study and sow units showed the highest incidence of PEDv, with 32 out of 40 of the sow units (80.0%) reporting PEDv. The study also showed that units were more likely to acquire the disease if they were near units that had experienced PEDv.

National Library of Medicine Publication

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4692406/>

April 3, 2014

Vermont had its first confirmed case of PEDv in April. The National Animal Health Laboratory Network reported a downward trend in positive case submissions although eight diagnostic labs reported positive test results.

National Hog Farmer News Article

<https://www.nationalhogfarmer.com/health/pedv-outbreak-winding-down>

March 22, 2019

Several pigs were diagnosed with PEDv at the Oklahoma Youth Expo (OYE). This was later confirmed at Oklahoma State University's Oklahoma Animal Disease Diagnostic Laboratory. Several pigs became ill and it is assumed most pigs at the show were exposed. Specifically, the pigs of the 2019 Night of Stars show and the pigs in the gilt and barrow shows. It was recommended that all biosecurity measures be implemented to prevent the disease from spreading to farms when the pigs were brought home or sold.

National Hog Farmer News Article

<https://www.nationalhogfarmer.com/livestock/oklahoma-youth-swine-show-breaks-ped-virus>

Oklahoma State University News Article

https://news.okstate.edu/articles/agricultural-sciences-natural-resources/2019/stotts_pedv-at-oye.html

Swine Health Disease Monitoring

<https://www.swinehealth.org/disease-monitoring-reports/>

Horses

Equine Herpesvirus (EHV-1)

May 13, 2016

A facility in Palm Beach County, Florida was placed under quarantine after a horse tested positive for EHV-1. The horse was showing neurological signs, which often include staggering, incoordination, inability to stand, weakness in the hind limbs, toe-dragging, and abnormal body positions. The horse was euthanized for humane reasons after being examined. There were 18 other horses at the facility which were clinically normal (not showing any signs of illness). However, biosecurity measures were put in place and the horses' temperatures were taken daily to detect illness. All states that may have had another horse that came in contact with the infected horse or the facility it was staying in were notified.

Equine Disease Monitoring

<https://www.equinediseasecc.org/alerts>

- When you get to the page, fill in the disease listed (e.g. EHV-1), then click on the state identified (e.g. Florida) and scroll down to the date (e.g. May 13, 2016) to get the background information.

April 2, 2019

A horse was confirmed positive for EHV-1 in Humboldt County, Nevada. The horse is a 14-year-old quarter horse mare. She first exhibited clinical signs on March 21st. An epidemiological trace (investigation as to where the disease was first contracted) was done and showed that the horse was most likely exposed at a rodeo in Fernley, Nevada on March 8-10th. The horse was stabled with five other horses, so the entire facility was placed under quarantine. A rodeo for April 5-7th was postponed.

Equine Disease Monitoring

<https://www.equinediseasecc.org/alerts>

When you get to the page, fill in the disease listed (e.g. EHV-1), then click on the state identified (e.g. Florida) and scroll down to the date (e.g. May 13, 2016) to get the background information.

March 2021

In March 2021, several facilities in Chester County, PA, were affected by EHV-1 with more than 30 horses with known or suspected exposure. Only one horse had to be euthanized after showing significant neurological issues. The remaining horses were all quarantined and monitored for signs of illness. Many developed fevers and had some neurological impairment (staggering, incoordination, etc.) but all recovered.

Penn State Extension News

<https://extension.psu.edu/ehv-1-outbreaks-in-pennsylvania>

Equine Infectious Anemia (EIA)

September 7, 2018

A horse was confirmed positive for EIA in Weld County, Colorado. The horse arrived in the county from another state on July 18, 2018. The horse did not have a negative EIA test or Certificate of Veterinary Inspection (CVI) prior to arriving, which is required for state-to-state travel. The horse was tested for movement to Wyoming and left Weld County on August 20, 2018 with a pending EIA test and no CVI. The Colorado Department of Agriculture traced all the horses that were imported and exported from Weld County since the arrival of the positive horse. All horses exposed to the positive horse were placed on a hold order until they received a negative EIA test and a negative EIA re-test.

Colorado Livestock Association News

<https://coloradolivestock.org/equine-infectious-anemia-confirmed-in-colorado/>

December 4, 2018

A horse was confirmed positive for EIA in Fremont County, Colorado after routine testing for transportation of the horse were done. The horse was quarantined in the county. This case is unrelated to the previous EIA positive horses in 2018. The state determined that the risk of disease transmission was low at the time because it was at the end of Colorado's fly season. However, 149 horses were exposed in Colorado and their owners were notified. The horses were all placed on hold orders until they tested negative for EIA.

Journal Advocate News

http://www.journal-advocate.com/business/sterling-agriculture/ci_32313596/fourth-eia-positive-horse-identified-colorado

To stay current on disease outbreaks in horses visit:

<https://www.equinediseasecc.org/alerts>

Cattle

Bovine Spongiform Encephalopathy (BSE)

December 24, 2003

A meat processing plant in Washington state had to recall five tons of beef because it may have been exposed to tissues containing BSE. The USDA announced that a cow in Washington state was the first U.S. animal to be identified with BSE. The plant, Verns Moses Lake Meats, recalled 20 carcasses which meant about 10,410 pounds of beef was recalled. The beef had been shipped to two other establishments for further processing. The cow was a "downer" cow culled from a dairy herd. All down animals are inspected by the USDA at slaughter. Because there is no live animal test for BSE, the cow could not have been diagnosed when she was alive. The dairy operation where the cow is from has 4,000 cows on two properties. The entire operation was quarantined and no animals were allowed to enter or leave the premises, either alive or dead. Although the

high-risk materials, the brain, spinal cord, and certain parts of the intestines, do not make it into the food supply, countries around the world stopped importing U.S. beef after hearing about this incident. Those countries included, Japan, South Korea, China, Taiwan, Singapore, Malaysia, Russia, and South Africa. In 2002 U.S. beef exports were worth \$2.6 billion, equivalent to about 10% of all beef production in the U.S. Losing the ability to export beef to many countries could have a large impact on U.S. beef production.

Centers for Disease Control and Prevention (CDC) - BSE Cases Identified in the United States

<https://www.cdc.gov/prions/bse/case-us.html>

- Select 2003 - Washington State

CDC MMWR News Article

<https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5253a2.htm>

Poultry

Highly Pathogenic Avian Influenza (HPAI)

December 2014 – June 2015

More than 50 million chickens and turkeys either died of Highly Pathogenic Avian Influenza (HPAI) or were euthanized and properly disposed of to stop the spread of the disease. The birds accounted for 12% of the U.S. table-egg laying population and 8% of the inventory of turkeys grown for meat. Bird loss per affected operation averaged 50,000 for turkeys and 1 million for layers. Egg and turkey production decreased because of the large number of birds lost or destroyed. Trade restrictions were placed on poultry commodities for export. Because of the loss of export markets, the broiler industry took serious economic losses even though few broiler birds were lost to HPAI. Having more supply than usual for domestic markets, prices received for broiler meat was much lower. The U.S. poultry industry can recover quickly from production losses from disease, but the market impacts, like trade loss and price instability, persist.

CDC MMWR News Article

<https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6404a9.htm>

Sheep

Sarcocystosis

June 23, 2017

The Food Safety Authority of Ireland (FSAI) confirmed that lamb carcasses had become infected with the sarcocystis parasite. It was identified by veterinarians who saw cysts on some of the carcasses. The Ireland Department of Agriculture destroyed over 400 lamb carcasses as a result. The animals were traced back and it is believed the outbreak originated in the Donegal region, possibly from contaminated dogs. These lamb carcasses never made it into the food chain for human consumption.

Farming Independent News Article

<https://www.independent.ie/business/farming/sheep/disease-outbreak-sees-over-400-lamb-carcasses-destroyed-35859182.html>

Pneumonia

Washington state is home to 1,690 bighorn sheep split into 17 herds. In 2010, they had a large outbreak of pneumonia among resident bighorn sheep herds. Because of this, about one third of the Umtanum herd had to be euthanized and properly disposed of to stop the disease from spreading. Washington also had another large outbreak in 2013 and terminated an entire herd, the Tieton herd, to prevent the adjacent herd, the Cleman Mountain herd, from becoming infected. This is not uncommon in bighorn sheep populations. Bighorn sheep populations that are infected with pneumonia, typically lose anywhere between a third and 90% of the herd. Survivors become immune but young lambs are not immune and often die within a few months. Annual outbreaks occur in some herds for decades, while other herds return to normal relatively quickly. No one is sure why this happens.

Bighorn Sheep Disease Research Consortium

<http://bighornhealth.org/about-pneumonia>

Washington Department of Fish and Wildlife

<https://wdfw.wa.gov/species-habitats/diseases/pneumonia>

Goats

Goat Plague Disease

October 13, 2017

An Ibex kid and adult were seen showing all the symptoms of goat plague and were blood tested. Local herders had been reporting potential sick individuals as well. In Mongolia, the saiga population also had individuals with symptoms of goat plague. This was the first time the disease was seen in Mongolia, so the country's reaction and prevention actions were slow. Less than 4,000 individuals are left due to outbreaks of goat plague. Goat plague is officially known as peste des petits ruminants (PPR).

WWF News Article

<http://wwf.panda.org/?313812/Ibex-is-being-infected-with-goat-plague-disease-outbreak>

New Scientist News Article

<https://www.newscientist.com/article/2119724-goat-plague-wipes-out-10-per-cent-of-endangered-antelopes/>

Appendix C – DIY Agar Petri Dishes

Author: Debbie Reed

<p>Total Time Approximately 2.5 hours</p>	<p>Active: 15 minutes Wait: 20 minutes + 2 hours</p>	<p>Agar Petri dishes should be made by the instructor</p>
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Materials

Items to Purchase or Included in Kit

- 30 sterile petri dishes
- Agar powder pre-measured in jar
- Gloves
- Clean spoon

Additional Items Needed

- Access to microwave
- 500 ml water (1 standard size drinking bottle)
- Pot holder or kitchen towel
- Safety goggles
- Lab coat or kitchen apron
- Tablecloth
- Paper towels

Note: This DIY agar plate method will not produce sterile plates since the agar was not autoclaved before use. It is adequate for use in the activities in this manual but not for research purposes.



Plate Making Procedure - approximately 35 minutes

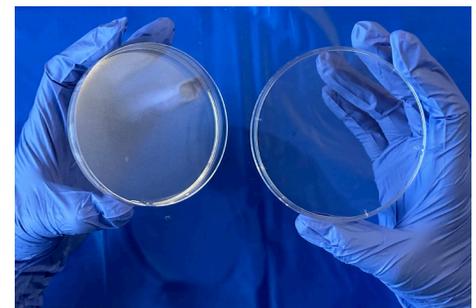
1. Before starting find a clean surface to work on, gather your materials, put on your safety goggles, lab coat (or kitchen apron), and gloves.
2. You may want to cover your work space with a disposable table cloth and have paper towels available to wipe up any spills.
3. Add 500 ml of water (1 standard size drinking bottle) to the jar with the pre-measured agar powder.
4. Stir the mixture with a clean spoon until the agar powder has dissolved.
5. Put the agar-water solution into the microwave - **DO NOT COVER OR PUT METAL LID IN MICROWAVE.**
6. Microwave for 4 minutes. Keep a close eye on the solution to make sure it does not boil over.
7. **The glass and the agar solution will be very hot!** Let the solution cool until the jar is cool enough to pick up - about 15 minutes but still warm and pourable. Use a pot holder or kitchen towel to remove the jar from the microwave.
8. While the agar solution is cooling layout the petri dishes so that you can easily access them. Keep the lids on.
9. Once cool enough to handle pour the warm agar into each of the 30 petri dishes. Lift the lid of each plate just enough to pour in the solution then replace the lid immediately to limit contamination.
10. You will only use a small amount of agar for each plate. You want just enough to cover the bottom of the plate to about an 1/8 to 1/4 inch thickness.
11. To keep from over filling your plates, pour until 3/4 of the bottom of the plate is covered, replace the lid and gently swirl the plate on the top of the table until the solution fully covers the bottom. If the bottom is not fully covered add a small amount more of the agar.
12. If the agar becomes too thick to pour, remicrowave until pourable.
13. Once all plates are poured discard any remaining agar solution.
14. Let the plates sit until the agar is fully solidified. About 1 to 2 hours depending on how thick the agar layer is and room temperature.
15. Once fully solidified store the plates upside down with the lids on so that any built up condensation does not drip on the agar.
16. Use the plates within 24 hours.



Pour the 500 ml bottle of water into the glass container with the agar powder. Use a clean spoon to stir the mixture until the agar powder is fully dissolved.



Pour until 3/4 of the bottom of the plate is covered, replace the lid and gently swirl the plate on the top of the table until the solution fully covers the bottom.



A finished and solidified agar plate. Agar is on the left and lid on the right.

NOTE: The glass jar may be washed thoroughly and reused. Additional agar powder and petri dishes or prepared agar plates can be purchased through Nasco, Amazon, a local veterinarian, etc.



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**This information has been reviewed
by University faculty.**

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