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OKLAHOMA COOPERATIVE EXTENSION SERVICE

THE UNIVERSITY OF ARIZONA Cooperative Extension

SCRUB: Science Creates Real Understanding of Biosecurity Instructor Guide

Cleaning and Disinfecting Activities

– Kris Hiney, Betsy Greene and Brittani Kirkland, Authors –

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A Quick Glance at 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 Active: 25 minutes Wait: 0 minutes	Difficulty Level	Group Size
Approximately 30 minutes		Easy	Class

Materials

- 1 bottle of Glo Germ™ lotion or gel
- 1-2 UV lights (depending on class size)
- Access to a sink, soap, and paper towels (not included)
- 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 Active: 20 minutes Wait: 0 minutes	Difficulty Level	Suggested Group Size
Approximately 40 minutes		Intermediate	Five per group

Materials (per group)

Teacher:

- Soil
- Powder Glo Germ™
- Sifter
- Popsicle stick or spoon
- Water

For Students (per group)

- Soap
- 1 gallon of water
- 1 plastic backed tablecloth (cheap)

For Students, continued

Five different material pieces which differ in texture (suggestions below):

- 1 foam piece (e.g. playroom flooring)
- 1 plywood piece
- 1 treated wood sample
- 1 flexible plastic cutting board mat
- 1 tile
- 1 scrub brush
- 2 small scrub brushes (fingernail brushes)

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 **Active:** 35 minutes + 90-minute wait **Wait:** 4 days for bacterial growth	**Difficulty Level**	**Suggested Group Size**
Approximately 55 minutes + a 5-day, 1.5 hour wait		Intermediate	Four/group

Materials (per group)

Incubator

- 1 box
- 5 styrofoam pieces
- 1 indoor/outdoor thermometer
- 1 light bulb
- 1 socket/plug for light bulb
- 1 extension cord

- 4 swabs
- 4 agar plates (see prep, make 24 hrs ahead)
- Disinfectant (commercially available, recommend Lysol)
- 4 "dirty" items to disinfect (see activity sheet for instructions).
- Proper disposal options for agar plates

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.

Perform the activity and look at the results the following day for early signs of bacterial growth.

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USDA
United States Department of Agriculture
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SCRUB Kits Development Team

Betsy Greene, PhD
Extension Horse Specialist/Professor
University of Arizona

Kris Hiney, PhD
Equine Extension Specialist/Assoc. Professor
Oklahoma State University

Visit https//agbiosecurityproject.org/about-adbcap/collaborators/ for team biographies.

SCRUB Kits were developed through a collaboration between Betsy Greene, University of Arizona, and Kris Hiney, Oklahoma State University, to complement the Biosecurity Learning Modules developed by the Animal Disease Biosecurity Coordinated Agricultural Project (ADBCAP) education team.

The SCRUB Kits link hands-on activities with science, technology, engineering and math (STEM) education, by incorporating science into fun activities and engaging youth in grades 6 to 12 with an existing interest in animal science. The SCRUB kits fill 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.

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

At the conclusion of this activity, participants will experience and evaluate their personal hand washing effectiveness in comparison with washing hands according to World Health Organization (WHO) guidelines.

Total Time	**Prep:** 5 minutes **Active:** 25 minutes **Wait:** 0 minutes	**Difficulty Level**	**Group Size**
Approx. 30 minutes		Easy	Class

Materials

- 1 bottle of Glo Germ™ lotion or gel
- 1-2 UV lights (depending on class size)
- Access to a sink, soap, and paper towels (not included)
- Access to a darkened area (to see fluorescence)

Video Links

- Effective Hand Washing Activity Overview Video for Instructors - https://youtu.be/w0DQosKdsR4
- How to hand wash? With soap and water - https://www.youtube.com/watch?v=3PmVJQUCm4E

Setup/Preparation – Approximately five minutes

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

- Do you think you wash your hands properly?
- Can you guess what parts of your hands you may miss when you wash?
- Do you think *you* contaminate any other surfaces when you wash your hands?
- 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. It is washable but 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 Challenges

Activity Objective

This activity will illustrate how important material surfaces are to your ability to effectively clean either between animals or in the event of disease outbreak. Think about places where animals from different facilities may gather together.

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

Materials

*Per group

Teacher:

- Soil
- Powder Glo Germ™
- Sifter
- Popsicle stick or spoon
- Water

For Students (per group)

- Soap
- 1 gallon of water

For Students, continued

Five different material pieces which differ in texture (suggestions below):

- 1 foam piece (e.g. playroom flooring)
- 1 plywood piece
- 1 treated wood sample
- 1 flexible plastic cutting board mat
- 1 tile
- 1 scrub brush
- 2 small scrub brushes (fingernail brushes)
- 1 plastic backed tablecloth (cheap)

Video Link

- Facility Sanitation Challenges Activity Overview for Instructors - https://youtu.be/GSi7OzNHRy4

Setup/Preparation – complete before students arrive: approximately 20 minutes.

1. Mix ½-1 teaspoon of sifted Glo Germ™ powder into ½-1 cup of soil. Use UV light to check media is thoroughly "contaminated" with the Glo Germ™ powder. Add more Glo Germ™ if needed.
2. Moisten the potting soil/powder mix with 2 tablespoons of water. The consistency should be firm, but water should come out if squeezed. 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. 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?

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 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.
    a. Allow students to come up with their own strategies, including how to clean and in what order.
3. Or: A team of students works 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 through 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

In this activity, students will explore the use of disinfectants and the importance of following product instructions on the growth of bacteria.

Total Time	**Preparation:** 20 minutes + 24-hour wait **Active:** 35 minutes + 90-minute wait **Wait:** 4 days for bacterial growth	**Difficulty Level**	**Suggested Group Size**
Approximately 55 minutes + 5 day, 1.5 hour wait		Intermediate	Four/group

Materials

Each Group Will Need:
Incubator

- One box
- 5 styrofoam pieces
- 1 indoor/outdoor thermometer
- 1 light bulb
- 1 socket/plug for light bulb
- 1 extension cord
- 4 swabs
- 4 agar plates
- Disinfectant - recommend Lysol
- An appropriate method to dispose of the contaminated agar plates.

- 4 "dirty" items to disinfect
  - We recommend shoes or rubber boots that would be commonly worn in animal facilities. These can be items the students bring in or items in your classroom.
  - Ideally, ask students to bring in rubber boots or something they have used at home that is already "dirty".
  - Alternatively, ensure materials used are made dirty by "walking around" outside to expose them to bacteria (students can do this). Make sure there is enough organic matter present on the item that they are visibly dirty.

Video and Website Links

- Incubator Building Overview for Instructors - https://youtu.be/XNsPsQYrNBo
- Disinfecting Activity Overview for Instructors - https://youtu.be/KePZ5F6IfEE
- 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

Instructor

1. Either prepare agar plates according to manufacturer's directions.
    a. Allow 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.

Potential Sources:

- https://tinyurl.com/nascoagar
- https://tinyurl.com/amazonagar

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?

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 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.

1. Have each group put together their 12" x 12" box, taping the bottom and leaving the top open.
2. Line the insides with the 1" styrofoam provided.
3. Place the temperature sensor portion of your thermometer in the box to monitor temperature.
4. 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.
5. 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!
6. Fold the top of the box (four-way fold) to close it. This will allow the box to be opened relatively easily - https://www.youtube.com/watch?v=LiQCdrAEBKg
7. You may duct tape the bulb into place if desired (not required).
8. 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.?