HFHA Biosecurity Learning Module 2 Screenshots: Routes of Infection & Means of Transmission

Screenshots of all module layers. Each screen is numbered in the order it appears in the module. Section 2 (separate document) includes accessibility screenshots for participants using screen readers.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image1" alt="Image of a cow with text: Biosecurity Routes of Infection Means of Transmission" /></td>
</tr>
<tr>
<td>2</td>
<td><img src="image2" alt="Image of cows with text: You may already know a lot about how to prevent illness from spreading from person-to-person. But did you know that animals can pass diseases between each other too?" /></td>
</tr>
<tr>
<td>3</td>
<td><img src="image3" alt="Image of a sheep with text: When animals get sick, we need to help them get better and make sure other animals don’t get sick, too. The first step in keeping animals healthy is knowing how animals can get a disease and how it can spread from one animal to another." /></td>
</tr>
</tbody>
</table>
**Biosecurity Learning Module**

**Healthyagriculture.org**

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### Objectives

In this lesson, we will introduce you to many animal diseases. Don’t worry! You are not expected to know these diseases ahead of time nor are you expected to remember them at the end of the lesson. They are for examples only.

At the end of this lesson you should be able to:

- Identify five routes of infection
- Describe how diseases are transmitted

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### What You Need to Know to Prevent a Disease from Spreading

Knowing the answers to the following 6 questions helps us to devise ways to prevent the disease from spreading to other animals:

- Who can get the disease?
- What effect does the disease have on their bodies?
- When is the animal most likely to get the disease?
- Where is the disease found in the environment?
- Why is this disease important to know about?
- How can this disease spread to other groups of animals?

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### The Disease Story

Let’s explore the disease stories of two different owners and their animals.

As you listen to the stories, use the notebook below to take notes to help you answer the six questions for each animal.

You can look up terms in the glossary by clicking the link any time it appears in the upper right corner of the page.
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#### Routes of Infection: Means of Transmission

<table>
<thead>
<tr>
<th>My Term</th>
<th>My Definition</th>
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</tbody>
</table>

#### My Notes

Create your own list of words and definitions:

Use this space to keep notes of things you think are important or want to learn more about.

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#### Meet Gus

MEET GUS

Rabies

Meet Ben

Who
What
When
Where
How
Why
I let my dog "Gus" out of the house to run around and heard him yelp. I smelled something terrible and saw him being chased by a skunk. I called him back to me and we ran into the house. I was worried that the skunk was going to attack me too! Now we need to bathe Gus and tell my parents. Boy, does he stink!

My parents think the skunk had rabies, so I looked up rabies on the Centers for Disease Control website...It said there are different strains of rabies virus found in different mammals in the USA, like bats, raccoons, foxes, skunks, and coyotes. But all mammals can get rabies if bitten by an infected animal, including people!
On the CDC website, it said that rabies is caused by a virus that infects nerve cells. The virus multiplies and grows inside the nerves and then travels up the nerves to the spinal cord and the brain. That means if an animal gets bitten near its head, rabies signs will occur faster than if it was bitten on a back leg. Depending where on the body the bite occurred, it can take 4 months or more before an animal shows signs of rabies, such as unusual behavior, seizures, drooling, and trouble moving.
Gus

Biosecurity
Routes of Infection
Means of transmission

Meet Gus

Who
What
When
Where
How
Why
Meet Ben

“Boy:

The good news is that Gus is up to date on his rabies vaccination, but the county public health officer and my veterinarian say that Gus still has to be observed for 45 days to see if he shows any signs of rabies.

I was curious about where rabies comes from. My mom suggested I call my vet who is a veterinarian. I was surprised at how many different kinds of animals get rabies. I also looked at the CDC website again and found the great map of the US showing where rabies is found. Check it out.

Gus

Biosecurity
Routes of Infection
Means of transmission

Meet Gus

Who
What
When
Where
How
Why
Meet Ben

I learned the main way the infection spreads to animals or humans is by contact with the saliva of an infected animal... Her from a bite or even just getting saliva in an open cut or wound.

Sometimes saliva can get in your eyes, nose or mouth and you can get rabies, but not very often. Or sometimes through an organ transplant.

Whether it's a person or an animal that gets infected, make sure to wash the bite really well with soap and water for 5 minutes, and then you need to see your doctor or vet for medical help.

At the very least, try to identify the animal that bit you or your pet and tell your parents.
It's a good thing I didn't get bitten. If I had been, I would have needed a series of shots to help my body fight off the virus.

The best protection for people is to make sure the animals close to us don't get rabies. The best way is keeping them up-to-date on their rabies vaccination. Any livestock that are in a rabies-infected area should be vaccinated, too.

Meet Ben

Ringworm

I had a steer that I had raised to take to the state fair. A couple of weeks before the show, I put him in his own stall in our old barn so I could give him special hay and a special grain, and get him ready to show. The day before the show I went to give him a bath and I found patches of skin on his head and neck where he had no hair and his skin was kind of gray and flaky. My parents told me to call our veterinarian.

It turns out my steer had ringworm, a fungus that any mammal – including humans – can get.
*After each section in the Ben story, a question and answer screen appears.*

**Ben**

**Meet Ben**

Who
What
When
Where
How
Why

**Biosecurity**

**Routes of Infection**

**Means of Transmission**

**Ben’s Ringworm Story**

Who can get the disease?

What affects does it have on the body?

When is the animal most susceptible?

Where is the agent found in the environment?

How can this disease spread?

Why is this disease important?

**Answer**

type your answer here

**Biosecurity**

**Routes of Infection**

**Means of Transmission**

Meet Gus

Meet Ben

**Ringworm**

Ringworm lives moist areas such as in the folds of skin, but they can grow anywhere. The fungus uses skin and hair and nails as food, which is why animals get bald patches. And it can get in the skin, which is listenning and can cause itching. If the animal scratches a lot the skin can break or get cut in it and then TBHI can get infected. What is meant?**

**Biosecurity**

**Routes of Infection**

**Means of Transmission**

Meet Gus

Meet Ben

**The vet says that moving the cow into a new place and all alone could’ve stressed him out and made it harder for him to fight off the fungus infection.**

**Biosecurity**

**Routes of Infection**

**Means of Transmission**

Meet Gus

Meet Ben

**The vet says that moving the cow into a new place and all alone couldve stressed him out and made it harder for him to fight off the fungus infection.**
The vet told me the fungus can be on almost anything: other animals, the soil, equipment, walls, dirt floors, and especially where there are lots of nooks and crannies – places that are hard to clean. That’s why it’s better to use metal parts in buildings, instead of wood.

Ben

My steer could’ve gotten the fungus from contaminated soil outside, or from wood in the old barn. Or he could’ve gotten it from another animal, but I don’t know if any others that have it, so far.

Our vet said that sunshine seems to keep the fungus under control. Also keeping everything clean and disinfected, and not sharing grooming tools... and don’t stress the animals, especially the young ones.

Ben

I couldn’t get the ringworm off! Just by touching and petting my steer, especially when I was feeling the skin patches. But I made sure that I washed my hands really well after that and I wore gloves when I groomed him until he was all cleaned up. And I made sure I disinfected his grooming tools every day and I didn’t use them on any other animals. We also kept my steer away from the other animals.

My dad and I tried to clean and disinfect the old barn, but it’s hard because everything is made of old wood. We were worried that any animal we put in there could get ringworm and spread it to all the other animals, so my dad decided to use it for our machine shed and storage barn now on.
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Biosecurity
Routes of Infection
Means of Transmission

Meet Gus
Meet Ben

Hover over each circle for pop-up description

Explore the 5 Routes of Infection

Infection
An animal or person can get sick by eating food, drink, or putting something in their mouth, like a finger or object, that carries the disease agent. This is one way porcine epidemic diarrhea (PED) is spread in pigs.
Insecurity Routes of Infection
Means of transmission

Explore the 5 Routes of Infection

Inhalation
Some disease agents can be in the air that an animal or person breathes. Then it gets into the lungs and causes disease. A good example of this route of infection is cows contracting aspergillosis by breathing in the fungal spores.

There are many animals can contract a disease. We call these the "5 Routes of infection." Roll over each picture to learn more. You must explore all 5 before moving forward in the module.

Breaks in skin
One of the skin's main functions is to act as a barrier to keep out infections. But if there is a break in the skin, like a cut or a bite, some disease agents can get in to cause infection. This is what happens with rabies. A break in the skin is also the way that sheep and goats get contagious lymphadenitis, or CL for short, caused by Corynebacteria. Be careful! This is a zoonotic disease.

There are many animals can contract a disease. We call these the "5 Routes of infection." Roll over each picture to learn more. You must explore all 5 before moving forward in the module.

In utero
Disease agents can infect a fetus while it is in its mother's uterus before being born. Bovine viral diarrhea, or BVD, can infect a fetus through the bloodstream.

There are many animals can contract a disease. We call these the "5 Routes of infection." Roll over each picture to learn more. You must explore all 5 before moving forward in the module.
Mucous membranes
Mucous membranes are moist membranes that line our eyes and all body cavities open to the exterior, such as respiratory, digestive, urinary, and reproductive tracts. Disease agents can be absorbed by the mucous membranes and cause infections. For example, the mucous membrane of the eye is the main route of infection for pink eye.

There are 5 ways animals can contract a disease. We call these the “5 Routes of infection.” Roll over each picture to learn more. You must explore all 5 before moving forward in the module.

Incorrect
Try again

Click the “I” in this slide series for tips.
Correct

Click “X” to close the tip

Gus: breaks in skin

Ben: breaks in skin

Gus: I learned the main way the infection spreads to animals or humans is by contact with the saliva of an infected animal...like from a bite or even just getting saliva in an open cut or wound.

Ben: My steer couldn't have gotten the ringworm fungus from contaminated soil outside or from wood in the old barn. Or he could've gotten it from another animal, but I don't know if any others that have it...so far!

Submit
24b

**Routes of Infection**

What routes of infection were used for Ben and Gus?

Correct

Gus: **Breaks in skin**

Ben: **breaks in skin**

**Continue**

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**Consider these situations and click on the correct answer in the pie chart.**

A calf got Johne’s (pronounced “YO-neez”) disease by nursing from an infected mother.

This calf got Johne’s disease when it ingested infected milk.

**Click NEXT to continue.**
Consider these situations and click on the correct answer in the pie chart.

A baby lamb got scrapie by coming in contact with fluids and tissues from the uterus after birth.

This lamb was infected by scrapie through its mucous membranes.

A young goat kept in a wood pen in an old barn got ringworm.
Consider these situations and click on the correct answer in the pie chart.

A young goat kept in a wood pen in an old barn got ringworm.

This goat caught ringworm through breaks in its skin.

Consider these situations and click on the correct answer in the pie chart.

Thin cattle on pasture seen breathing hard suddenly died. Tests show the cows died from pneumonia caused by a fungus called *aspergillus*.

Cattle inhaled *aspergillus* in the pasture.

Consider these situations and click on the correct answer in the pie chart.

Thin cattle on pasture seen breathing hard suddenly died. Tests show the cows died from pneumonia caused by a fungus called *aspergillus*.
Consider these situations and click on the correct answer in the pie chart.

Thin cattle on pasture seen breathing hard suddenly died. Tests show the cows died from pneumonia caused by a fungus called *aspergillus*.

Consider these situations and click on the correct answer in the pie chart.

Some calves were born with cloudy eyes two months after new cows were added to the herd. One of the cows was later found to be infected with bovine viral diarrhea (BVD).

Consider these situations and click on the correct answer in the pie chart.

Some calves were born with cloudy eyes two months after new cows were added to the herd. One of the cows was later found to be infected with bovine viral diarrhea (BVD).

*BVD was transmitted to the calves while they were still in their mothers’ uterus (before they were born).*

Click NEXT to continue.
We call this "means of transmission."

Remember Gus and Ben? How did each get their disease? Can it spread to other animals?

The skunk that attacked Gus was bitten by another animal that was infected with rabies. Until it dies, the skunk can spread the disease by biting other animals. Direct contact with saliva from the animal infected with rabies is required to transmit the disease.
Means of transmission

Remember Gus and Ben? How did each get their disease? Can it spread to other animals?

Click on each image to read the rest of the story.

Remember how Ben got ringworm? The fungus was in the wood of the old barn where he was kept. Ben must have rubbed up against the wood and got infected. The wood was an environmental reservoir for the fungus, which was able to infect the animal contacting it.

Means of transmission

How are diseases spread? By means of transmission. There are many ways of categorizing the means of transmission, and there are multiple terms used to describe them. Here is one way and a few of the terms.

Direct Contact

- Animal - Animal
- Animal - Human

Indirect Contact

- Fomite
- Vector

Hover Over each image
How are diseases spread? By means of transmission. There are many ways of categorizing the means of transmission, and there are multiple terms used to describe them. Here is one way and a few of the terms.

- Direct Contact
- Indirect Contact

Animals can also spread diseases to humans through indirect contact. Diseases passed from animals to humans (directly or indirectly) are called zoonoses.

- Animal - Animal
- Animal - Human
- Fomite
- Vector

Non-living objects like clothing, grooming equipment, or vehicles can carry infectious agents from one animal to another and are called fomites. Human hands, feed, and water are other potential sources of indirect exposure to disease.

Insects that carry disease agents are also called vectors. An insect vector may pick up an infectious agent when it bites one animal and pass it on to another one it bites.
The glossary link is in the top right of the slide (not shown here).
Another way to categorize the way diseases are spread between farm animals is shown below. You will explore these means of transmission in the next two modules.

**Means of transmission**

- **Direct Contact**
- **Indirect Contact**

Animals living together in pens can easily spread diseases to each other. Animals that were just purchased, borrowed, or returned from a fair or show can bring diseases with them and spread them to other animals through direct contact or the air.

People who care for animals can get diseases from direct contact with animals. Contamination on hands, clothes, and footwear can also spread diseases indirectly to animals.
Means of transmission

Another way to categorize the way diseases are spread between farm animals is shown below. You will explore these means of transmission in the next two modules.

Direct Contact

Indirect Contact

Grooming brushes, shovels, and tractors are examples of items that can move disease-causing agents from one area to another and spread disease indirectly. Facility design and the presence of vectors are also important factors associated with indirect disease transmission.

Means of transmission

Another way to categorize the way diseases are spread between farm animals is shown below. You will explore these means of transmission in the next two modules.

Direct Contact

Indirect Contact

Feed and water are essential to the health of animals, but if they are contaminated, they can be means of disease transmission.

Let’s Review

Can you explain, in your own words, the different means of transmission?

<table>
<thead>
<tr>
<th>Term</th>
<th>Your Explanation</th>
<th>Compare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct:</td>
<td>type your definition here</td>
<td></td>
</tr>
<tr>
<td>Indirect:</td>
<td>type your definition here</td>
<td></td>
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Let's Review
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<th>Your Explanation</th>
<th>Compare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct:</td>
<td>Close contact between non-infected and infected animals.</td>
<td></td>
</tr>
<tr>
<td>Indirect:</td>
<td>Contact with things or animals that carry the disease but are not infected.</td>
<td></td>
</tr>
</tbody>
</table>

Let's Review
Can you identify the routes of infection?
Below are some of the terms you have learned today. Drag the terms that describe routes of infection and put them in the box on the left. Drag all other terms to the box on the right.

Routes of Infection
- Inhalation
- Mucous membranes
- Ingestion
- In utero
- Indirect Contact

Not a Route of Infection
- Rabies
- Breaks in skin
- Fomite
- Vector

CORRECT
Click the “X” to go back

Rabies: Where I live rabies is commonly found in raccoons and bats. These infected animals can bite our cattle. That’s why our veterinarian vaccinates our herd every year to protect them.

Scrapie: We had an outbreak of Scrapie on our sheep farm. We thought we were getting it under control, but then a newborn lamb got it from contact with fluids and tissues from the uterus after birth.
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#### Means of transmission

- **Leptospirosis**: After a series of abortions in our dairy herd, leptospirosis was diagnosed as the cause. The vet said that this disease is spread by rats in the barn. He told us to make sure rats and other rodents can’t get into the feed storage and recommended an effective vaccine schedule for the cows.

- **Toxoplasmosis**: I always enjoy watching our barn cats and playing with the kittens. The vet was out visiting our goats and noticed the kittens. She was concerned the kittens might be using the goat grain as a litter box and spreading toxoplasmosis to our goat. We’re going to keep a litter box in the barn for the cats and keep the grain covered from now on.

- **Ringworm**: I was raising a calf for my 4-H project and took her to the county fair. If she did well there I was going to enter her in the state fair. I was grooming her before the show when someone next to me asked if they could borrow my brush because they couldn’t find theirs. My calf won a blue ribbon! So I signed her up for the state fair. But sadly, just before the state fair started I noticed bald, scaly patches on her skin. Turns out she has the ringworm fungus! That’s when I remembered loaning my brush at the county fair. Big mistake!!
**Let’s Review**
**Means of transmission**

**Bluetongue:** Our lambs were out on pasture in the late summer. Boy, were there a lot of small biting flies! Then, within a week or so our lambs started having runny noses and noisy breathing. Their faces and tongues started swelling, and they had high fevers. Many died and the ones that survived didn’t do so well for a few months. Turns out those flies were carrying the Bluetongue virus.

**PED:** My family has a pig farm. Last spring we had a litter that all had diarrhea. Our veterinarian had the manure tested and the Porcine Epidemic Diarrhea virus was found. We lost almost all the piglets in that litter. The vet told us that there was another infected farm that uses the same feed mill that we do. She thinks the delivery truck may have brought PED into our farm. We are much more careful now and follow much stronger biosecurity rules when working with our pigs. It seems to be working. We’ve had much less diarrhea and a lot fewer deaths since then.

**CL:** We keep a small herd of dairy goats. A few days after we bought a new dairy goat we noticed a lump just behind its ear. We didn’t think much about it until a couple of days later it became an open sore that was oozing pus. The other goats were sniffing and licking it. Yuck! A few weeks later we noticed other goats had lumps too. Our vet said it was something called caseous lymphadenitis, but the name CL is a lot easier to say and remember. The pus is full of a type of bacteria than can spread to other goats, so we put the goats with lumps and abscesses into a separate pen away from other goats.
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Let's Review
Means of transmission
Click on terms to the left to hear them pronounced and read more about them. Drag each cause on the bottom to the correct means of transmission in the chart and select submit.

<table>
<thead>
<tr>
<th>Direct Contact</th>
<th>Indirect Contact</th>
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<tbody>
<tr>
<td>bat bite (Rabies)</td>
<td>afterbirth (Scrapie)</td>
</tr>
<tr>
<td>contact with abscess (CL)</td>
<td>delivery truck (PED)</td>
</tr>
<tr>
<td>bluetongue</td>
<td>shared Brussels (Ringworm)</td>
</tr>
</tbody>
</table>

Rabies  Scrapie  Leptospirosis  Toxoplasmosis  Ringworm  Bluetongue  Porcine Kidney 
Diarrhea  Caseous Lymphadenitis

CORRECT <BACK NEXT>

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Biosecurity Routes of Infection
Means of Transmission

Summary
Routes of Infection
(You can print the summary using the print button in the navigation bar on the bottom of your screen.)

Ingestion: By mouth
An animal or person can get sick by eating food, drink, or putting something in their mouth, like a finger or object, that carries the disease agent.

Inhalation: By breathing in
Some disease agents can be in the air that an animal or person breathes and then gets into the lungs and causes disease.

Breaks in skin:
One of the skin's main functions is to act as a barrier to keep out infections. But if there is a break in the skin, like a cut or a bite, some disease agents can get in to cause infection.

In utero:
Disease agents can infect a fetus while it's in its mother's uterus before being born.

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Biosecurity Routes of Infection
Means of Transmission

Summary
Means of Transmission

Direct Contact
A method of spreading disease between an infected animal and a susceptible one by touching, licking, biting, or sneezing on each other.

Indirect Contact:
A method of spreading disease through fomites, vectors, human hands, feed, or water.

Zoonotic: Referring to disease passed from animals to humans or vice versa, directly or indirectly.

Fomite: Non-living object like clothing, grooming equipment, or vehicle that can carry infectious agents from one animal to another.

Vector: An insect that carries one or more disease agents. An insect vector may pick up a disease agent when it bites one animal and pass it on to another one it bites. Sometimes the vector is required for the disease agent's life cycle and sometimes it is not.