Utah Asthma Task Force
www.health.utah.gov/asthma

Animal Science Course

Under Agricultural Science Core **Standard 3**-Students will understand animal anatomy and physiology as it relates to nutrition, health, and management of domesticated animals.

New **Objective:** Understand how to maintain your respiratory health while managing domesticated animals.

Learning Goal: Understand asthma risks when working in agriculture and how to protect your respiratory health.

Student learning objectives:
1. Define work-related asthma.
2. Discuss when to wear a respirator and the correct type.
3. Demonstrate how to do a respirator fit check.

List of resources:
Utah Department of Health Asthma
National Ag Safety Database
Occupational Safety and Health Administration (OSHA)
Lab activity 1 adapted from NOVA: http://www.science.org.au/nova/007/007act02.htm

List of equipment, tools, supplies and facilities:
Writing Surface
Overhead Projector
MSDS
Copies of student lab sheet
Materials for lab

Terms:
Respiratory system
Occupational asthma
Respirator fit check
Chronic
Material Data Safety Sheets (MSDS)

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. Possible approaches are included here:
Pass out MSDS on common household cleaners and highlight the information on protective equipment needed.
Movie Clip/ story about asthma attack

Summary of Content and Teaching Strategies:

Objective 1: Define work-related asthma

Anticipated Problem: What is asthma?
Asthma is a chronic lung disease that can make it hard to breath. Chronic means lasting long term. People with asthma have airways that are hyperresponsive, meaning that their airways react to asthma triggers such as cold, cigarette smoke and exercise faster and more intensely than people whose airways are normal.

What happens during an asthma episode?

- The lining of the airways become inflamed and swell.
- More mucus is produced, making the opening in the airways smaller.
- The muscles around the airways tighten, also making the opening in the airways smaller.

Triggers of Asthma
A trigger is any object, act, or event that causes the airways to become inflamed or causes asthma symptoms. The muscles in the airways react to triggers and causes them to contract, tighten and narrow, making it harder to breath.

Common triggers include:

- Exercise
- Virus Infection (cold, bronchitis, pneumonia)
- Cigarette smoke
- Outdoor or indoor air pollution
- Allergens, such as cats, dogs, dust mites, cockroaches, grass, mold, and pollen
- Cold air
- Some medicines and chemicals
- Occupational exposures, such as chemicals or dusts
- Sinusitis or other respiratory tract infections

Signs and Symptoms
Asthma signs and symptoms differ from person to person and by what trigger the individual has been exposed to.
Common signs and symptoms include:

- Wheezing
- Coughing
- Feeling tired
- Shortness of breath
- Tightness or heaviness of chest
- Difficulty breathing with exercise

- Night cough

A person may have some or all of these symptoms at any time.

Work-related asthma is asthma that is caused or made worse by something at work.

Agriculture is considered a high-risk industry for work-related asthma. Farmers are exposed to many occupational asthma triggers but there are things that can be done to reduce risk.

There are two types of work-related asthma:

- Work aggravated asthma: Asthma that is made worse by exposures at work in someone who already had asthma.
- Occupational asthma: New asthma that develops after exposures at work in someone who didn't have asthma before.

Work-related asthma symptoms usually occur after you are exposed to the trigger, and often improve or go away when you leave work. Some people may not have symptoms until 12 or more hours after being exposed to the trigger. Symptoms usually get worse toward the end of the work week and may go away on weekends or vacations. However, the effects of work-related asthma are often caused by exposures which over time can damage the lung by scarring because of inflammation. This scar damage is not reversible which can lead to symptoms that are persistent and permanent.

Objective 2: Discuss when to wear a respirator and the correct type

Anticipated Problem: Who needs respiratory protection?
Respiratory refers to the respiratory system which includes your nose, mouth, trachea (windpipe), bronchi, lungs, alveoli and the diaphragm. Oxygen is taken into the body through the mouth or nose, absorbed into the lungs, and then transported through the body in the blood. When working in agriculture there are many factors that can prevent the respiratory system for working right.

According to the National Ag Safety Database those who need respiratory protection include those who:

- work in dusty fields and buildings
- handle moldy hay
- work in silos
- feed or work with feedstuffs
- work in corn silage
- uncap silos
- clean grain bins
- work in areas where bird droppings or dust from animal hair, feathers, or fur are present
- work with fish meal
- apply agricultural chemicals ((e.g. fertilizers, pesticides, fumigants)
- work with toxic paints or solvents

- work in areas where dust containing old paint, rust and wood particles

Respiratory protection equipment is placed in one of two categories: 1) air purifying respirators (APR); or, 2) supplied air respirators (SAR).
Air purifying devices remove contaminants from the air and are used only where there is enough of an oxygen supply. These devices include mechanical filter, chemical cartridge, and canister gas mask respirators.
Supplied air respirators are used when there is not enough oxygen in the area you are working. These respirators include supplied-air respirators and self-contained breathing apparatus (SCBA).

In case the respirator cannot or will not be used a simple mask should be used. The respirator is more efficient at removing the particles but a mask will still help.

If you are unsure which type of protective equipment is best for your work check the Materials Safety Data Sheets (MSDS) for recommendations. MSDS is intended to provide workers and emergency personnel with information on how to handle or work with a certain substance in a safe manner, and includes information such as physical data (melting point, boiling point, flash point, etc.), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill-handling procedures.

Most types of protective respiratory equipment can be found at safety supply stores. Farm supply stores and agricultural chemical suppliers are also good places to find protective respiratory equipment.

Objective 3: Demonstrate how to do a respirator fit check.

Anticipated Problem: What is a respirator fit check?
Fit testing should not be confused with a respirator fit check. A fit check is the method you use to ensure that the respirator you are using does not have an air leak. A fit check, or "user seal check" as it's referred to by OSHA (Occupational Safety and Health Administration) should be performed each time a tight-fitting respirator is put on to ensure there's an adequate seal.

1. Positive fit check – exhale while covering the exhalation valve with the palm of your hand – if you feel air against the skin of your face, there is a leak in the seal.
2. Negative fit check – cover the cartridge(s) with your hands and inhale –if the mask is drawn tightly to your face, there is no leakage.

Make sure the respirator properly fits you. An air leak makes the respiratory less effective. Testing the equipment will assure a proper fit and protection.

Answers to Sample Test:

1. False
2. True
3. MSDS
4. b

5. Inflammation, mucus production and airway muscle constriction.
6. A trigger is any object, act, or event that causes the airways to become inflamed or causes asthma symptoms.
7. Exercise, Virus Infection (cold, bronchitis, pneumonia), Cigarette smoke, Outdoor or indoor air pollution , Allergens(such as cats, dogs, dust mites, cockroaches, grass, mold, and pollen), Cold air, Some medicines and chemicals, Occupational exposures (such as chemicals or dusts),Sinusitis or other respiratory tract infections.

Sample Test:

1. True or False? A positive fit check is when you cover the cartridge with your hands and inhale. If the mask is drawn tightly to your face, there is no leakage.
2. True or False? Occupational asthma is a type of work-related asthma.
3. Where can you go to find information on what protective equipment you should be using?
4. Which of these is a category of respiratory protection equipment?
   a. air filtering masks
   b. supplied air respirators
   c. chemical neutralizing respirators
   d. purified oxygen masks
5. List the three physical changes that happen during an asthma episode.
6. Define the term asthma trigger?
7. Name 4 common asthma triggers.

Let us know how it went. We are always trying to improve this lesson plan. Please send any comments or suggestions to the Utah Asthma Program (asthma@utah.gov).

Lab Activities (Two possible activities depending on supplies available):

Activity 1
Measure the volume of air you can exhale

Note: Students suffering from respiratory or heart problems should not act as subjects for this activity.

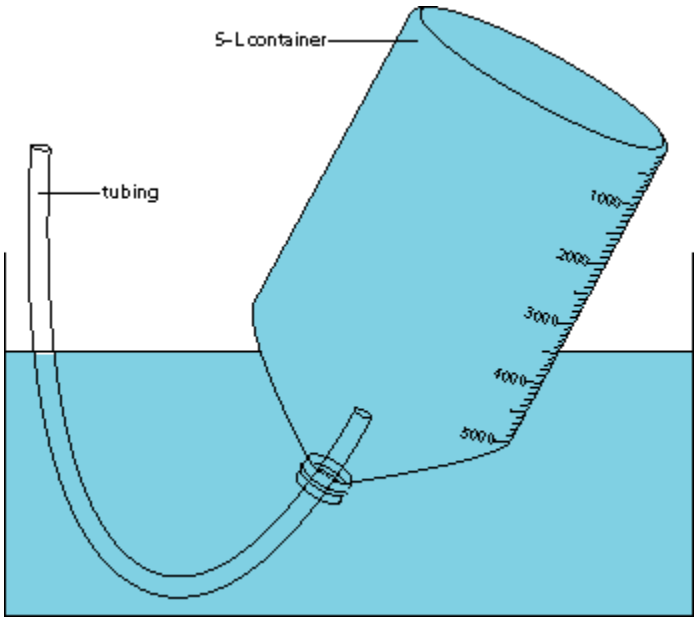
During an asthma attack the smooth muscle lining the air passages of the lungs becomes constricted and the volume of the air that can be exhaled is decreased. Using a large plastic bottle, you can approximately measure the maximum volume of air that can be exhaled during forced breathing.

Materials (for each small group)

- 5-litre (or larger) plastic bottle with lid (bottle should be marked with 100 ml gradations);
- half a meter of tubing (rubber or plastic);
- Sink or large plastic container.

Procedure

1. Fill a sink or large plastic container with water.
2. Fill the plastic bottle to the top with water and put the lid on.
3. Turn the bottle upside down in the sink and take off the lid under water.
4. Insert a length of tubing into the bottle as shown in the diagram.



5. Take a deep breath and expel all the air in your lungs through the tubing and into the bottle.
6. Record the volume of air you have forced into the bottle (vital capacity).
7. Refill the bottle and set up the apparatus as before.
8. Relax for a few minutes until your breathing pattern returns to normal.
9. Repeat the experiment twice.

10. Average the values you obtain.

Questions

a. Why would measuring the forced expiratory volume on a regular basis be helpful in a person with asthma?
b. Do you think there are differences between males and females?
c. Based on the results you discovered what do you think the average vital capacity is?

Teacher's notes

Students suffering from respiratory or heart problems should not act as subjects for this activity. Make sure students do not become competitive in their exhaling.

This activity should be done in groups of two (or more). While one student is exhaling another is needed to stabilize the bottle. Provide a new length of tubing for each student.
You may want students to calculate a class average. Students could compare the average volume exhaled by females with that exhaled by males or they could look for a correlation between volume of air exhaled and height of the student.

Remind students the volume they are measuring is the vital capacity of the lungs (Average values Male 4.6 L, Female 3.6 L) which is more than that exhaled during normal breathing (tidal volume) but less than the total lung capacity. (Some air always remains in the lungs because the thorax cannot be completely collapsed.)

Students can also measure the tidal volume of their lungs using the set-up for this activity. They could use the large plastic bottle or a 500-mL cylinder. The plastic bottle will only give a very approximate reading but will show students that the tidal volume is only small compared to the vital capacity.

Answers

a. It allows the individual to determine whether or not there asthma is in good control and if their symptoms are flaring up before a asthma attack.
b. Males typically have larger lung volumes.
c. Average values Male 4.6 L, Female 3.6 L

Activity 2
Asthma Attack

This activity helps the class understand what it feels like to have an asthma attack.
Note: Students suffering from respiratory or heart problems should not act as subjects for this activity.

Materials

- One drinking straw for each member of the class
- Strips of paper labeled: sitting, standing, jumping jacks. One for each student to help randomly divide them into groups.
- 3 watches

Procedure

1. Pass out a straw to each member of the class
2. Divide the students into their various groups
3. Assign one member of each group to be the time keeper for the activity. **(This job can be given to students suffering from respiratory or heart problems as they will not be physically active)**
4. Each student, except the time keeper, will place their straw in their mouth and plug their nose. Requiring the student to breathe through the straw.
5. Time keepers will then record the how long in minutes and seconds each group can continue breathing through the straw while either sitting standing or doing jumping jacks.
6. Record for each group when the first person has to stop the activity due to shortness of breath and when the last person stops the activity.
7. Come together and discuss the various symptoms the groups felt and the various times within each group.
8. Talk about how this activity demonstrates that asthma attacks can vary from person to person depending on activity, health and environmental factors.