Investigating the Fungus Among Us

A 4-H Educational Curriculum on Mold
The youth of today are exposed to a number of environmental hazards on a daily basis. These hazards range from common household chemicals to hidden dangers such as radon and air pollution. Contact with these hazards can result in health issues including headaches, rashes, and difficulty breathing. Of these environmental hazards, one is especially common, but inconspicuous, often hiding from view—mold.

This unit takes a broad look at the vast world of mold. Often media represents only negative aspects of mold. However, this unit investigates both the benefits and the dangers of mold or mold-based products. By completing the activities in each of the five lessons, youth will examine the positive and negative attributes of mold, the conditions that promote mold growth, and how growth can cause illness. They will also learn methods used to deal with mold growth in the home.

These activities have incorporated multiple subject matter areas, using Florida's Sunshine State Standards as a reference. This unit builds science skills while also developing skills in health, language arts, theatre arts, and visual arts. The specific standards associated with each activity are charted on pages v and vi as well as noted on each lesson plan.

**LESSON FEATURES**

**BACKGROUND BASICS**

Each lesson begins with some BACKGROUND BASICS for you to review prior to beginning the activities. This information should help you better explain the topic and answer any questions not explicitly covered by the activity content.

**Lesson 1, The Fungi Kingdom** (pages 1–2), explains basic information about what mold is, what it looks like, common types, and how it grows.

**Lesson 2, Molds Magnified** (pages 11–12), gives basic information about Blue Cheese (for Activity 3).

**Lesson 3, The Science and Art of Mold** (pages 23–24), provides information for identifying mold in the home.

**Lesson 4, The Medicine of Mold** (pages 33–36), gives information about dealing with mold in the home (remediation/mitigation), and discusses health-related mold information.
ACTIVITIES AND LESSON TOPICS

Lesson 1: The Fungi Kingdom – Activity 1 (Yeast Feast) investigates common members of the Kingdom Fungi. The activities in this lesson allow youth to see the conditions necessary for the growth of fungi. Activity 2 (Fun Guys) continues looking at members of the Kingdom Fungi. Using various forms of art, youth can create a depiction of the fungi they are seeing.

Lesson 2: Molds Magnified – Activity 1 (Blue Cheese, Please) investigates the contributions that some molds make in the culinary arts, specifically in the creation of Blue Cheese around the world. These activities have youth map out the geographic locations of Blue Cheese producing countries. Activity 2 (Gross Out Garden) uses an experimental format to examine the conditions that promote mold growth on a variety of foodstuffs.

Lesson 3: The Science and Art of Mold – Activity 1 (A Toast to Mold) uses the findings from the previous activity to test conditions that promote mold growth. This lesson also introduces youth to the concept of mold as an art medium (Breaking the Mould). Activity 2 (Mold Master) allows youth to put their knowledge of favorable mold-growing conditions to use by looking for mold growth in the most likely places.

Lesson 4: The Medicine of Mold – Activity 1 (Mold Mitigation) uses theatre to educate youth on the methods used for prevention of and dealing with mold growth in the home. Youth then demonstrate what they have learned by creating a mini mold magazine for their parents. Activity 2 (Moldy Medicine) examines the benefits and dangers of mold. Youth learn about the details of mold in health/medicine through a board game — Shots and Triggers.

CURRICULUM COMPONENTS

| Target Age Range: | Summarizes target area and objectives; time allotments; life skills for each of the activities (left-hand column) |
| Life Skill: | Indicates which Life Skills are covered through the activities (see upper right corner) |
| Subject Area: | Provides tidbits of useful information for that specific activity (within the text) |
| Subject Matter Outcome: | |
| Sunshine State Standard: | |
| Time Needed: | |
| Materials Needed: | |
EXPERIENTIAL LEARNING IN 4-H

4-H Youth Development relies heavily upon the five steps of the experiential learning model to teach life skills. The sequential steps of the model help youth identify what they have learned from a 4-H experience or activity and to apply that learning to other experiences or situations. This model requires that the “teacher/leader” be very clear about the skill or concept targeted and that the experience and the processing questions are designed to support that learner goal. The experiential learning process engages the learners in all phases of the activity, resulting in the ability to generalize this learning to new situations.

Experience. Begin with concrete experience. This can be an individual activity or a group experience, but it involves “doing something.”

Share. Next, get youth to discuss the experience. Encourage open group discussion about reactions and observations.

Sharing Questions
- What did you do?
- How did you feel?
- What happened?
- How did it feel to...?
- What was most difficult?
- What was easiest?

Process. Discuss recurring themes, problems and issues brought out by the exercise.

Processing Questions
- Did problems/issues seem to occur over and over?
- What were they?
- What similar experiences have you had?

Generalize. Find general trends or common truths in the experience. Identify principles that apply to "real life," not just the activity.

Generalizing Questions
- What did you learn about yourself through this activity?
- What did you learn about the life skill (i.e., making decisions)?
- How did you go about making your decision?
- How do the major themes or ideas relate to real life and not just the activity?

Apply. Concentrate on how the new learning can be applied to everyday situations. Discuss how issues raised by the activity can be useful in the future.

Applying Questions
- How can you apply what you learned (making decisions) to a new situation?
- How can issues raised by this activity be used in the future?
- How will you act differently in the future as a result of this activity?

Experiences lead to learning if the participant understands what happened, sees patterns of observations, generalizes from those observations, and understands how to use the generalization again in a new situation. When this model is used, youth both experience and process the activity.

Benefits for youth participating in the experiential learning process may include:
- learning from each other by sharing knowledge and skills
- working together, sharing information and evaluating themselves and others
- taking responsibility for their own learning
- relating experiences to their own lives
TARGETING LIFE SKILLS FOR YOUTH

A skill is a learned ability. Life skills are those competencies that assist people in functioning well in the environments in which they live. Youth development professionals and volunteers are concerned with helping youth become competent in the life skills that will prepare them for transition to adulthood. 4-H focuses on developing skills that are healthy and productive for both youth and their communities.

Positive youth development programs identify the skills within the four targeted competency areas that are appropriate to the age of the youth in the program and offer experiences to teach these skills. Because skills are best learned through practice, many experiences that teach or reinforce skills must be provided. Mastery of any skill requires opportunities to try, make mistakes, and try again. The following graphic represents a system for targeting skills that lead to mastery of targeted competencies.

HEART: Personal/Social Competencies
- Relating: establishing a mutual or reciprocal connection between two people that is wholesome and meaningful to both.
- Caring: showing understanding, kindness, concern and affection for others.

HANDS: Vocational/Citizenship Competencies
- Giving: providing, supplying, or causing to happen (social responsibility).
- Working: accomplishing something or earning pay to support oneself through physical or mental effort.

HEAD: Knowledge, Reasoning, and Creativity Competencies
- Thinking: using one’s mind to form ideas and make decisions; to imagine, to examine carefully in the mind, to consider.
- Managing: using resources to accomplish a purpose.

HEALTH: Health/Physical Competencies
- Living: acting or behaving; the manner or style of daily life.
- Being: living one’s life; pursuing one’s basic nature; involved in personal development.

Adapted from Patricia Hendricks, VI-960601 PH November 1996.
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<tr>
<th>BENCHMARK</th>
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*** The same standard exists for grades 6–8; the only difference is the reference to appropriate grade level subject matter
THE FUNGI KINGDOM

This lesson serves as an introduction to the Fungi Kingdom. Using both science and art, youth will be able to examine a variety of members of the fungal family.

IN THIS CHAPTER...

The two activities in this chapter have been designed to promote exploration of fungi basics.

Activity 1: Yeast Feast
- **Content Focus Area:** Science Skills
- **Life Skill:** Following Instructions
- **Desired Outcome:** Youth will be able to identify general members of the fungi kingdom and recognize conditions that aid in fungal propagation.

Activity 2: Fun Guys
- **Content Focus Area:** Visual Arts and Art History
- **Life Skill:** Learning to Learn
- **Desired Outcome:** Youth will be able to identify the structure of mold and other common fungi and then create an abstract artwork representing a mold or fungi.

BACKGROUND BASICS

The living organisms on earth can be categorized into six different groups, called kingdoms. One of these six kingdoms is Fungi. Molds are a type of fungi. And like most living things, molds

- use energy;
- generally are made of one or more cells;
- use food to sustain themselves and produce wastes;
- reproduce;
- grow, change, or develop over time;
- interact with their surroundings; and
- have a life span (a beginning and an end).

Fungi are a critical part of nature's circle of life. Fungi feed by absorbing nutrients from the organic material in which they live. Fungi are decomposers. They break down dead organic material, like leaves or stumps, and use the carbon to live. Some fungi are parasites. They cause diseases by using living organisms for food. These infect plants, animals, and even other fungi.
What does mold look like?

Mold consists of filamentous, microscopic cells called hyphae (collectively called mycelia), and asexually produced spores, which give mold colonies their powdery look. Enzymes released from the fungal cells and absorbed by the fungus as nutrients digest the organic materials in which hyphae grow. This process is what we know as decay, an essential ecological process, causing the deterioration of foods, textiles, and structural materials.

For fungi, the largest part of the organisms usually remains hidden from the naked eye. The living body of the fungus is a web of tiny filaments called hyphae. This web, or mycelium, is usually hidden in the soil, wood, or whatever food source the fungus has connected itself to. These webs live unseen until they develop fruiting bodies, such as mushrooms, puffballs, truffles, brackets, or cups. If the mycelium produces microscopic fruiting bodies, people may never notice the fungus.

Like all living organisms, fungi must digest their food before it can pass through the cell wall into the hyphae. However, fungi do not have stomachs. So, they digest the food outside their bodies by releasing enzymes into the surrounding environment. This breaks down the organic matter into a form it can then absorb.

To reproduce, fungi release spores from the fruiting body. The fruiting body, called a sporocarp, releases spores into the air, and the wind carries the spores off to start the next generation.

Examples (What are some examples?)

Some common indoor molds are:
- Cladosporium
- Penicillium
- Alternaria
- Aspergillus

Common blue and green molds are mostly species of Penicillium and Aspergillus. These cause foods like fruits, vegetables, and jams to spoil. The term mildew is often used generically to refer to mold growth, though some debates exist as to the proper definition for the word.

One uncommon, but very dangerous, indoor mold is Stachybotrys. It is unusual to find Stachybotrys in a home unless the home has been flooded or otherwise suffered extreme and prolonged water damage.

Growth/Propagation (How do they grow?)

It is hard to say how many species of fungi exist, but estimates range from tens of thousands to perhaps three hundred thousand or more. Mold requires a source of nutrition, water, oxygen, and appropriate pH and temperature ranges to grow. When located in warm, damp, and humid conditions, molds quickly grow and spread. Since the "ideal" temperature for growth is between 68 and 86 degrees, homes in the southern and western United States are particularly susceptible to mold growth. Unlike a matured mold, mold spores can survive harsh environmental conditions, such as extreme drought.
INTRODUCTION

Have 4–5 examples of mold-derived foods in front of the youth. If you choose, you can also provide a taste test for the more adventurous youth. Allow youth who tasted the foods to share their reactions to the foods with those who did not.

Ask youth to brainstorm: What do these items have in common? Some commonalities may be: they are all foods, they can be eaten safely, the cultures they are found in, the distinct smells, and the distinct tastes. Tell youth: Another commonality is that these objects have all been affected by the presence of one ingredient. What ingredient could all these have in common? Allow youth to respond.

Bring out your piece of moldy bread. Ask youth: How would this piece of bread fit in with the items before? What differences do these objects have? Some differences may be: the bread can’t be eaten safely, they come from different cultures, some smell and some don’t. Reveal to youth that: All of the items I have shown you have been affected by the presence of MOLD. The first objects were CREATED using mold; the piece of bread was being DESTROYED by mold.

ADVANCED PREPARATION

Purchase and prepare: Collect samples of 4–5 foods that use mold in the production process for youth to sample.

Create a piece of moldy bread: Use a piece of bread that has the lowest amount of preservatives you can find (fresh-baked bread vs. shelf bread). Mist the bread lightly with water. Put the piece of bread in a plastic zipper bag and seal. Place the bag in a warm area out of direct sunlight (on top of the refrigerator works well). Mold growth should appear in 3–5 days. DO NOT open the bag—the molds grown inside the bag may be toxic. Instead, let youth examine the bread while it is safely sealed inside the bag. You may want to place a piece of masking tape across the top of the bag to prevent anyone from accidentally opening it. Throw away the entire sealed unit (bag, bread, and mold) once done.

Create 6 mystery samples: Place each sample in a plastic zipper bag. Each group will get 1 mystery sample to test. Make each sample about the same size (grams/oz) as one packet of dried yeast. Two samples should be just yeast; 2 samples should be half yeast, half talcum powder; 2 samples should be just talcum powder. Use food coloring to alter the color of the samples.

Materials Needed: Refer to the Materials Box next to each activity.

Target Age Range:
Grades 5–8

Life Skill:
Critical Thinking

Subject Area:
Science Skills

Subject Matter Outcome:
Youth will be able to:
• identify general members of the fungi kingdom.
• recognize conditions which aid in fungal propagation.

Sunshine State Standard:
SC.5.N.1.1  SC.6.N.1.1

Time Needed:
15 min. for introduction; 35 min. for activity; 10 min. to discuss results.

Materials Needed:
Refer to the Materials Box next to each activity.

Materials
For Introduction:
• 4–5 examples of food that uses mold in the production process. These may include: blue cheese, Roquefort (cheese), Camembert (cheese), Brie (cheese), Gorgonzola (cheese), soy sauce, sake, tempeh, and miso. Choose a variety rather than all cheese products to enhance discussion of commonalities.
• 1 piece of moldy bread (see preparation method above)
This step takes at least 3–5 days to prepare.
Ask youth: **So, what is mold?** Molds are a type of fungus that can be found both indoors and outdoors. **Is it alive?** Molds are made up of filamentous, microscopic cells called hyphae (collectively called mycelia), and asexually produced spores. This gives mold colonies their powdery appearance. The organic materials in which hyphae grow are digested by enzymes released from the fungal cells and absorbed by the fungus as nutrients.

Ask youth: **How do you know that mold is alive?** They grow, they eat, they use energy, they have cells, and they reproduce. Tell youth: Mold, like other living organisms, requires certain things to grow. We are going to look at what organisms need in order to grow using another type of fungus, a close relative of mold, called yeast.

**ACTIVITY 1 — YEAST FEAST**

(Demonstrates that both water and nutrients are necessary for fungi to grow)

Adapted from [http://www.uen.org/](http://www.uen.org/).

Lead youth through this activity. The steps are included here and on the youth handout. As you proceed, ask the questions to provoke thought and conversation about what is going on.

**STEP 1:** Pour one yeast packet into the plastic zipper bag. Zip the bag then shake. **Energy is something all organisms use.** By shaking the bag, we just added energy to the yeast. Did anything happen to cause the yeast to change in shape or size? What might the yeast need in order to cause it to grow? Youth should think of the **food source** first (the sugar).

**STEP 2:** Have youth add 1 tsp sugar to the yeast in the plastic zipper bag. Zip the bag. **Food is something that all living organisms need in order to grow.** Has anything happened by adding the sugar to the yeast? What else might need to be added to the bag in order for the yeast to grow?

**STEP 3:** Have youth add the ¼ cup of water to the yeast/sugar in the plastic zipper bag. Zip the bag. **Water is also something that all living organisms need in order to grow.** It is just as important as food. Has anything happened by adding the water to the yeast and sugar?

**STEP 4:** Record your observations for the yeast at the times indicated on your handout (10, 20, and 30 minutes.)

Ask youth: **How do we know that the yeast is alive?** What evidence is there? Youth should point out that there was **growth** (change in size). There was also **release of gas** (cells give off carbon dioxide as waste when they work).
Investigating the Fungus Among Us
A 4-H Educational Curriculum on Mold

Lesson 1 — The Fungi Kingdom
Activity 1 — Yeast Feast

Tell youth: Now that you have learned about some of the crucial things organisms need in order to grow, let’s perform the same test on a “mystery sample.” What do you predict might happen when we test our mystery sample?

**STEP 5:** Use what you learned about what living organisms need to grow from the previous activity to test your mystery sample.

**Now...**

**REFLECT**
- Is yeast a living organism? How do you know?
- Was your mystery sample yeast? How do you know?
- Explain the process you used to determine whether the mystery sample was yeast.
- What was the hardest part of the activity? Why?
- What did you expect to happen when we added the sugar? Were you disappointed when nothing happened?
- Would your results have been different if you had just simply poured everything into the bag at one time? If you had put the water in first, instead of the sugar, would those results be different?

**APPLY**
- What were the differences that you found in the mystery samples?
- How could these differences be explained?
- You learned that water is necessary for living things to grow & function properly. What does this mean for your body?
- You compared a known to an unknown in order to come to a conclusion. How might you use this process in your daily life?
- When you perform science investigations, you need to be able to make predictions and defend your conclusions. What other areas in your life can you think of in which you need to predict outcomes or defend your conclusions?

**EXTENSION ACTIVITIES**

Tests the yeast using variables:

- Does the amount of light change the reaction time?
- Does the amount of sugar change the reaction?
- Does the amount of water change the reaction?
- Does temperature influence mold growth?
- Does shaking the bag increase reaction time?
- Do different containers alter the reaction?
**Yeast Feast — Worksheet**

**Getting Started:**
Perform the steps below as your leader instructs you to. Be sure not to jump ahead.

**Step 1:** Pour one yeast packet into the plastic zipper bag. Zip the bag, then shake.

**Step 2:** Add ______________ to the yeast in the plastic zipper bag. Zip the bag.

**Step 3:** Add ______________ to the yeast in the plastic zipper bag. Zip the bag.

**Step 4:** Use the information you collected from the activity to set up the same test for your mystery sample.

**Step 5:** Record your observations for both your known bag and your mystery bag at the times indicated below.

<table>
<thead>
<tr>
<th>Known Sample</th>
<th>Mystery Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start</strong></td>
<td><strong>Start</strong></td>
</tr>
<tr>
<td><strong>After 10 minutes</strong></td>
<td><strong>After 10 minutes</strong></td>
</tr>
<tr>
<td><strong>After 20 minutes</strong></td>
<td><strong>After 20 minutes</strong></td>
</tr>
<tr>
<td><strong>After 30 minutes</strong></td>
<td><strong>After 30 minutes</strong></td>
</tr>
</tbody>
</table>

**Conclusions:**
What conclusions can you make about your mystery sample?

This activity was adapted from http://www.uen.org/.
**ADVANCED PREPARATION**

Collect samples for observation. It is best to collect several examples of fungi indigenous to your area. Organisms can be examined at both a macroscopic (with the naked eye) and microscopic (with the aid of a microscope) levels. The suggestions below (in green box) are suggestions for both levels. Set up the samples of fungi around the room. Make sure they are spread out enough for youth to be able to view the specimen at the same time (for the art portion of the activity.) **NOTE:** Be sure to use caution when collecting and handling fungi. Some are toxic. Always wash your hands after handling specimens.

**INTRODUCTION**

Lead youth through this activity. The steps are included here and on the youth handout. As you proceed through the process, ask the questions to provoke thought and conversation about what is going on.

Tell youth: **Here are some items I have collected from our local outdoors. Take a few minutes to look at each of these. What do they have in common?** Allow youth to respond; answers may include that they are all forms of fungi.

These are all types of fungi, like the mold and yeast from our last activity. Some fungi can be examined with the naked eye, and some would need to be observed using a microscope to see the structure. If you look closely, you can see unique patterns, shapes, and colors throughout these samples.

Ask youth to: **Explain the structure of the fungi. What parts do these fungi have?** Allow youth to respond; answers may include that they have a stem (this is the mycelia or group of hyphae that releases enzymes in order to break down food sources and then absorb the nutrients for the fungi) and a cap (which is the fruiting body where the spores are stored for reproduction).

**In order to capture this natural beauty, we are going to become artists. Most of you probably don’t think of yourselves as artists, and that is O.K.! We are going to use styles that do not require your drawings to be perfect. Instead, you are going to try to capture the light and colors of what you are seeing, rather than just focusing on specific details. Pass out Handout 2.**
On the Handout you’ve just received are three well-known artists who chose to capture the beauty of nature around them, and each in a different way. Review the information on Monet, Picasso, and O’Keefe from the Background Information for your knowledge.

As you can see on the Handout, Monet was an impressionist. He captured the impression he got from what he was seeing, using short brush strokes instead of solid lines. Picasso was a cubist. He used shapes and colors to create the images of what he saw. O’Keefe worked using abstract pieces of what she saw, and sometimes even an extreme close up. Give youth an opportunity to look over the handout. They should be able to get an idea from the pictures on the handout of the styles of each artist.

**Activity 2 - Fun Guys**  
(Youth observe the parts of common fungi, including mold)

Let’s begin. I want you to walk around again, looking at the various types of fungi that have been collected. As you are looking at the fungi, think about what you are seeing. Imagine how you might capture that image on a piece of paper. Which style of art would you use? Allow youth to begin looking at the samples of fungi you have provided.

As the youth are walking around, looking at the samples, tell them... Once you have looked at both the macroscopic and microscopic samples, choose which one(s) you would like to use for your piece of art. Decide which of the artist’s styles you will use.

Once youth have finished looking at the samples, provide each with their “canvas,” the paper that you’ve chosen for this activity. If you have chosen to capture a macroscopic fungi, situate yourself where you can see it, without moving it from its current location. If you have chosen to use a microscopic fungi, you may have to share the microscope with someone else. So, look at your sample, take a mental photograph, and then move away so someone else can use it. Once they are done, you can return if you need to. Make sure you fill up your canvas. Be creative. Remember, you are trying to capture the essence of what you are looking at.

**Materials**

Give each small group (2–3 youth) the following materials:
- Art Paper (Bristol, Watercolor, or card stock paper works best) cut into 5"x5" squares (1 for each youth)
- Pencils
- Media for artwork — Paints work best (tempura, acrylic, or watercolor.) Markers, colored pencils, pastels, or crayons can be used.
- Handout 2 on Artists Up Close

Images are a part of the public domain available through Wikipedia
REFLECT

- How did you feel as you examined the samples of fungi?
- Did your view of the fungi things change after thinking about them as natural beauty and art?
- Have you ever had an experience (positive or negative) with one of the fungi we saw today?
- What process did you go through as you looked at the samples?
- What type of details did you try to capture for your work of art?
- Which artist’s style did you choose to imitate? What about the works of art you saw, or may know about, made you choose that style?

APPLY

- What were some common characteristics you noticed in each of the samples?
- What were the differences that existed?
- What other ways can you think of that you could capture what you saw today?
- The artists that we used as examples (Monet, Picasso, and O’Keefe) all looked at the nature around them in different ways and tried to capture what they saw and felt on the canvas. How can being able to look at something in a different way apply to your life?

EXTENSION ACTIVITIES

Design a collage from photos, magazine pictures, or other sources to represent the Kingdom Fungi.

Create a poster board mural of your collages for your school media center or hallway.

Research another artist and his/her style, then recreate your work of art using that style.
ARTISTS UP CLOSE

Claude Monet (November 14, 1840–December 5, 1926) was one of the founders of French impressionist painting. He was so instrumental to this movement that the term Impressionism is derived from the title of his painting Impression, Sunrise (shown to your right).

Impressionist paintings have distinguishable characteristics:
- short, thick strokes of paint — used to quickly capture the essence of the subject, rather than the details
- colors applied side-by-side (very little mixing)
- grays and dark tones produced by mixing complimentary colors — pure Impressionism avoids the use of black paint
- wet paint placed into wet paint — this creates softer edges and blended colors
- playing with natural light, especially the reflection of colors from object to object (like the sun on the water)
- shadows boldly painted with sky blue, showing the reflection of the sky onto those surfaces — this technique was inspired as artists observed the blue shadows that exist on snow

Pablo Picasso (October 25, 1881–April 8, 1973) was a Spanish painter and sculptor. One of the most recognized figures in 20th century art, he is best known as the co-founder of Cubism (the other was Georges Braque).

Two major divisions in Cubism
Analytical Cubism was developed between 1907 and 1912. Analytic Cubists look at nature as if it were made up of basic shapes, such as cones, cylinders, spheres, and angles. They would then transform what they saw into basic geometric parts on a two-dimensional plane. Due to this, the works of art tended to depict the object from many different perspectives. Color was almost non-existent except for the use of a monochromatic scheme that often included grey, blue, and ochre.

Synthetic Cubism was developed by Picasso and others between 1912 and 1919. If Analytical Cubism “breaks apart” nature into geometric pieces, Synthetic Cubism “pushes” several objects together. It was seen as the first time that collage had been made as a fine art work. The picture on the left, Musiciens aux masques (Three Musicians), is one of Pablo Picasso’s works that was created using Synthetic Cubism.

Georgia O’Keeffe (November 15, 1887–March 6, 1986) was an American artist. She has been a major figure in American art since the 1920s. She is best known for her paintings in which she creates colorful abstract representations of flowers, rocks, shells, animal bones, and landscapes.

Her artistic philosophy evolved from her work with Arthur Dow. He believed that the goal of art was the expression of the artist’s personal ideas and feelings. He also felt that the best way to capture the subject matter was through the arrangement of line, color, and notan (the Japanese system of lights and darks). She adopted this philosophy as her own. Her works of art present forms that capture these elements (line, color, and notan) in beautiful abstract forms as seen in her 1924 work Autumn Leaves, Lake George, N. Y. (the picture on your right). In addition to capturing simple objects such as leaves, shells, and flowers, her artwork also includes beautiful landscapes, cloudscape, and images that evoke the heart of the southwest United States.
This lesson focuses in on the group of fungi referred to as molds. The associated activities examine some positive uses and possible dangers found from dealing with the mold group.

**In This Chapter...**

The two activities in this chapter have been designed to promote exploration of fungi basics.

**Activity 3: Blue Cheese, Please**
- **Content Focus Area:** Geography
- **Life Skill:** Global Awareness
- **Desired Outcome:** Youth will be able to explain how molds are used to create cheese and locate cultures on a map which utilize mold in creating blue cheese.

**Activity 4: Gross-Out Garden**
- **Content Focus Area:** Science Skills
- **Life Skill:** Data Collection
- **Desired Outcome:** Youth will be able to identify mold and the conditions that promote mold growth.

**Background Basics**

**Blue Cheese Basics**
Blue cheese is a style of cheese that uses *Penicillium* cultures to create a unique color, odor, and taste. These cultures can be added before the cheese curds form or afterwards. This small difference can make a huge impact on the flavor and color of the wheel of cheese, but most blue cheese has a sharp, salty taste.

It is commonly believed that blue cheese was discovered by accident. Cheese used to be stored in caves in order to help cheese-makers maintain temperature and moisture levels while the cheese aged. However, these conditions were also perfect for growing mold cultures. One of the oldest blue cheeses, Gorgonzola, dates back to 879 A.D.

There are many countries that produce blue cheeses, several of which are listed on page 15.
We are going to do a taste survey. Each one of these blue cheese samples is from a different country. We are each going to taste one of the four pieces of cheese and then rank them in order of the strongest personality (taste, smell, appearance.) Allow youth to taste each sample. Have youth arrange the cheeses in order of weakest to strongest “personality.” Have water available for any who made need to rinse the taste out of their mouth.

Ask youth: Describe the “personality” of each cheese. How would you describe each cheese? Answers will vary based on the cheese you choose.
**Activity 3 — Blue Cheese, Please**

(demonstrates one positive use for mold in the culinary arts throughout the world)

Lead youth through this activity. The steps are included here and on the youth handout. As you proceed through the process, you can ask questions to provoke thought and conversation about what is going on.

Using the list on the back of the handout, locate the countries that produce each listed blue cheese. For each type of blue cheese, place a blue dot in the country that produces it. Once you are finished, try to predict which countries our taste survey samples came from.

Now...

**Reflect**

- How did you select which cheese sample had the best personality? What criteria did you use?
- What was the hardest part of this activity?
- Which countries seem to produce the most blue cheese?
- What country do you think Sample 1 is from? Sample 2? Sample 3? Sample 4?

**Apply**

- You had to guess which country each sample was from. What did you base your guess on?
- One type of mold used to create blue cheese is *Penicillium roqueforti*. What blue cheese do you think is made with this mold? How did you come to that conclusion?
- Did you use any opinions of the people from that country to make your guess?
- How can making generalizations about cultures or people cause problems?

**Extension Activities**

*Investigations on the World Wide Web*

Use resources on the internet to:

- search for the most expensive types of blue cheese. Try to figure out what about them makes them the “most expensive.”
- research the methods used to create blue cheese.
- investigate “cultures” by making your own yogurt. Many websites exist with recipes and instructions on how to prepare yogurt. If youth choose to do this activity, have them do so with adult supervision.
**BLUE CHEESE, PLEASE - Worksheet**

**Getting Started:**

Using the list on the back of this handout, locate the countries that produce these types of blue cheese.

For each type of blue cheese, place a blue dot in the country that produces it.

Once you are finished, try to guess which countries our taste survey samples came from.
**Blue Cheese, Please**

- Adelost - Sweden
- Aura - Finland
- Bavaria blu - Germany
- Bleu Bénédictein - Canada
- Bleu d’Auvergne - France
- Bleu de Bresse - France
- Bleu de Gex - France
- Bleu des Causses - France
- Bleu de Septmoncel - France
- Bleu du Haut-Jura - France
- Bleu du Vercors-Sassenage - France
- Blue Castello - Denmark
- Blue Wensleydale - England
- Buxton Blue cheese - England
- Cabrales cheese - Spain
- Cambozola - Germany
- Cashel Blue cheese - Ireland
- Cheshire cheese - England
- Danablu - Denmark
- Delft Blue - Netherlands

- Dolcelatte - Italy
- Dorset Blue Vinney cheese - England
- Fourme d’Ambert - France
- Gammelost - Norway
- Gamonedo - Spain
- Gorgonzola - Italy
- Harbourne Blue - England
- Lanark Blue - Scotland
- Lymeswold cheese - England
- Maytag Blue cheese - United States of America
- Moulin Bleu Goat - Netherlands
- Paladin Bavarian Blue - Germany
- Regina Blu - Germany
- Roquefort - France
- Saga cheese - Denmark
- Shropshire Blue cheese - Scotland
- Saint Agur Blue - France
- Stilton - England
- Valdeón cheese - Spain
- Westminster Blue - England
BLUE CHEESE, PLEASE - Answer Key

EUROPE:
Ireland - 1
Scotland - 2
England - 8
France - 10
Spain - 3
Germany - 4
Italy - 2
Norway - 1
Denmark - 3
Netherlands - 2
Sweden - 1
Finland - 1

NORTH AMERICA:
Canada - 1
United States of America - 1
ADVANCED PREPARATION

Gather Resources. Don’t use items with meat or fish in them; they will smell awful! Include some foods that are pre-packaged. Packaged foods contain a lot of preservatives and will not grow mold easily. This creates a nice comparison topic for discussion. Try to get a good variety of food in different jars so youth can see the difference between foods. ** Keep track of what you choose to bring in – you will need to bring the same items in for A Toast to Mold. **

CAUTION

CONTAINERS MUST BE DISPOSED OF!
Do not open jars once mold begins to grow.

When Disposing of Mold Jars
Carefully place sealed jars into a trash bag. Tie the trash bag and place into a garbage dumpster.

INTRODUCTION

Tell youth: We’ve spent some time looking at how mold contribute to the food industry in a beneficial way. However, not all molds on food are good. Remember my piece of bread? Instead of being used to create food, let’s take a look at how molds destroy food.

Molds use nutrients from other foods or plants to grow as they decompose the original food or plant. Sometimes they are really small and look like a fine powder when seen with bare eyes.

One place I’ve seen mold is in the bathroom around my shower. What do you think the mold likes about my shower? They need warmth, moisture, food. Molds like warm places and moisture, and, like all living organisms, they need food to stay alive. Today, we are going to create our own environments for mold to grow in.
ACTIVITY 4 — GROSS-OUT GARDEN  (Youth observe the growth of mold)

Lead youth through this activity. The steps are included here and on the youth handout. As you proceed through the process, ask the questions to provoke thought and conversation about what is going on.

Prior to selecting the food, ask youth to predict which food types might grow mold the fastest and slowest. Predict which jars will grow the largest and smallest amounts of mold. Have youth write their predictions in the space provided on the back of the handout. This provides a discussion reference at the end of the activity.

**STEP 1:** Give youth an opportunity to choose food for their jar. Encourage them to think about what molds need in order to grow and which foods might grow the best mold garden.

**STEP 2:** Youth should dip each piece of food into a bowl of water and then place them in the jar (try to keep all the food close enough to touch but not piled into a heap).

**STEP 3:** Put the lid on the jar. Use tape to write each group’s name on the jar and to tape around the lid to make sure it is secure.

**STEP 4:** Place jars in a place where they can remain undisturbed for a few days (WARMTH enhances growth, so near a window would be favorable). For the first couple of days, you will not see much, if any, mold, but within the next few days you should begin to see fuzzy white and green mold growing on the food.

**STEP 5:** Have youth periodically make sketches of their terrariums during the mold growing.

**STEP 6:** Keep the jars of mold sealed. Store the jars until they are used for the A Toast to Mold activity. NEVER OPEN THE JARS.

Materials
Give each small group (2–3 youth) the following materials:
- Handout 4 (1 per youth)
- Masking tape
- Water at room temperature
- Variety of food scraps
- One container with lid per small group — Container must be disposable, clean, and transparent.
**Investigating the Fungus Among Us**
A 4-H Educational Curriculum on Mold

**Lesson 2 — Molds Magnified**

**Activity 4 — Gross-Out Garden**

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**Now...**

**Reflect**
- Which food grew mold the fastest? The slowest? What do you think caused some foods to grow mold better than the others?
- How did your predictions about which foods would grow mold the quickest compare to the results? How about your predictions about the amount of mold?
- What steps did you use to collect and record information about your garden? How did you display the results to create a story about your garden?
- Were there different molds growing in the jar? How do you know? Where do you think these molds came from?
- It would be dangerous for us to open our containers once mold begins to grow. Why do you think this is?

**Apply**
- How could you share the information you collected about your mold garden with others? Which type of data do you think would be the most convincing? Why?
- Why is it important to develop a regular schedule of collecting data when performing an experiment over time?
- What challenges are there with recording and interpreting data?
- What other professionals might use similar experiments to study growth? (doctors monitoring culturing growth, scientists studying plant food or pesticides, etc.)
- Be aware of mold growth on foods. Look for mold growth on any food products at home or in a grocery store.

**Extension Activities**

Create other gardens based on what you observed throughout your garden or other people’s gardens. Be sure to use the same precautions in this garden that you followed in the last one.

Think about what variables you could change in order to get different results. Set up an experiment and test your hypothesis.
**GROSS-OUT GARDEN - Worksheet**

**Step 1: Predictions**
I predict that...

**Step 2: Observations**
Record your observations of your mold garden for 12 days. Use the form on the back to note each day’s change.

**Step 3: Conclusions**
What can you conclude from the results of mold growth on your food choices?

**Step 4: Recommendations**
What have you learned and what can you recommend for food safety practices based on your conclusions?
GROSS-OUT GARDEN  Keep track of what you see in your jar every day....

<table>
<thead>
<tr>
<th>DAY 1</th>
<th>DAY 2</th>
<th>DAY 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="jara.png" alt="Jar on Day 1" /></td>
<td><img src="jarb.png" alt="Jar on Day 2" /></td>
<td><img src="jarc.png" alt="Jar on Day 3" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DAY 4</th>
<th>DAY 5</th>
<th>DAY 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="jard.png" alt="Jar on Day 4" /></td>
<td><img src="jarf.png" alt="Jar on Day 5" /></td>
<td><img src="jar6.png" alt="Jar on Day 6" /></td>
</tr>
</tbody>
</table>
# Gross-Out Garden

<table>
<thead>
<tr>
<th>DAY 7</th>
<th>DAY 8</th>
<th>DAY 9</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Jar" /></td>
<td><img src="image2" alt="Jar" /></td>
<td><img src="image3" alt="Jar" /></td>
</tr>
<tr>
<td>DAY 10</td>
<td>DAY 11</td>
<td>DAY 12</td>
</tr>
<tr>
<td><img src="image4" alt="Jar" /></td>
<td><img src="image5" alt="Jar" /></td>
<td><img src="image6" alt="Jar" /></td>
</tr>
</tbody>
</table>
The Science and Art of Mold

This lesson continues the discussion of molds. The associated activities examine the attributes that aid in mold growth and how that growth can cause illness.

In This Chapter...

The two activities in this chapter have been designed for exploration of mold propagation.

Activity 5: A Toast to Mold
- Content Focus Area: Science Investigations
- Life Skill: Critical Thinking
- Desired Outcome: Youth will be able to hypothesize and test which conditions produce a desired mold effect.

Activity 6: Mold Master
- Content Focus Area: Science Investigations
- Life Skill: Data Collection
- Desired Outcome: Youth will be able to identify areas prone to mold growth by identifying the conditions which promote mold growth.

Background Basics

Location (Where are they?)
Molds are a type of fungi that can be found both indoors and outdoors. Outdoors they can be found in shady, damp areas, or in places where leaf matter or other vegetation is decomposing. Indoors they can be found in areas where humidity levels are high, such as in the basement or in showers.

In the Home
Environmental experts say that newer methods of construction using cellulose-rich materials have contributed to the vast outbreak of mold-related infestations in homes throughout America. These building materials create an environment that, under the right conditions, is ripe for mold propagation. In addition to the change in materials, homes are being built more airtight. This lack in proper ventilation leads to an increased retention of moisture in the home.
Where Should I Look?
There are many locations within the home that could house mold. It may be easy to see or completely hidden from sight. The most likely places involve any location where a cellulose-based material is exposed to water damage, condensation, or high humidity:

- basements or cellars
- underneath kitchen or bathroom sinks
- underneath or behind refrigerators
- behind walls that house plumbing
- in stacks of damp or wet newspaper
- around air-conditioning units
- around windows that leak
- underneath carpet that has become wet
- basements or cellars
- underneath kitchen or bathroom sinks
- underneath or behind refrigerators
- behind walls that house plumbing
- in stacks of damp or wet newspaper
- around air-conditioning units
- around windows that leak
- underneath carpet that has become wet

What Can I Look For?
By the time mold growth can be seen, it is likely that millions of invisible-sized mold spores are covering the surface. These tiny spores can easily become airborne and then be inhaled or come in contact with eyes, ears, and skin. Small spots and patches of discoloration (usually brown, green, or black) on surfaces that are often wet or water damaged are probably mold. Mold may also appear as white powdery blisters on painted surfaces since many molds can eat paint.

According to the Insurance Information Institute, additional signs of possible mold damage include the following:

- sunken areas in baseboards or trim – this occurs when the mold has eaten away the wood from behind the paint
- separation of the baseboard from the wall or floor
- whitish spots under carpet, linoleum, in cabinets, or even behind furniture
- staining, swelling, or crumbing plaster or sheetrock
- discoloration (blackish stains) around air-conditioning vents
- sunken areas in baseboards or trim – this occurs when the mold has eaten away the wood from behind the paint
- separation of the baseboard from the wall or floor
- whitish spots under carpet, linoleum, in cabinets, or even behind furniture
- staining, swelling, or crumbing plaster or sheetrock
- discoloration (blackish stains) around air-conditioning vents

Early response is the best way to get rid of mold or to prevent current mold growth from getting out of control. Cleaning small areas of mold when you first see it and identifying/repairing the source of the water damage are the first steps in early response to a mold problem. Since moisture is crucial for mold growth, the source of the water intrusion must be corrected; otherwise, the mold growth will recur, even if you clean regularly. For many residents, it is often too late for an early response; they are already in need of a major cleanup by the time a mold problem is confirmed.
Investigating the Fungus Among Us
A 4-H Educational Curriculum on Mold

Lesson 3 — Science and Art of Mold
Activity 5 — A Toast to Mold

Target Age Range:
Grades 5–8

Life Skill:
Critical Thinking

Subject Area:
Science Investigations

Subject Matter outcome:
Youth will be able to:
• hypothesize and test which conditions produce a desired mold effect.

Sunshine State Standard:
SC.5.N.1.1 VA.D.1.3.1
SC.5.N.2.1

Time Needed:
one 60 minute period
one 20 minute period
(3–5 days later; for results)

Materials Needed:
Refer to the Materials Box next to each activity

ADVANCED PREPARATION

Gather Resources. Gather the same food scraps that you did for Gross-Out Garden.

INTRODUCTION

Have 2–3 jars from the Gross-Out Garden in front of the youth. Ask youth to examine the jars closely.

What do you see? Allow youth to respond. Have youth look to see if certain color molds seem to be linked to certain food types (veggies, fruits, meats, breads, processed foods).

ACTIVITY 5 — A TOAST TO MOLD

(Edulates on the conditions necessary for mold propagation)

Separate youth into small groups of 2–3 persons each. Give each group the following materials: copies of Handout 5 and the materials above. Tell youth:

There are many forms of art. In the Fun Guys activity we looked at some famous artists who tried to capture the beauty of the nature that surrounded them. Recently, some artists have not only wanted to capture the beauty of a moment, but the beauty in the life of nature. Your handout describes one artist, who uses cultures to create works of art out of mold, creating living art.

Have youth begin the activity: Now you are going to create your own works of living art. As a group, you have 3 slices of bread and the same type of scraps as from the Gross-Out Garden. The bread is your canvas; the scraps are your paints. Think about what foods created what results. Experiment and have fun—smash them, mash them, squeeze the juices out of them. Once you have completed your work of art, seal your slices of bread in your plastic bag.
Perform this activity using different variables. Try using:

- a variety of breads (white, rye, wheat, nut, or pumpernickel)

**QUESTION:** Using the same conditions, which of the breads grows mold quickest?

**OR**

- only one type of bread (white, wheat, rye, nut, or pumpernickel)

**QUESTION:** Using variable conditions, determine those conditions under which mold will grow the quickest on the chosen type of bread.
A TOAST TO MOLD

Read the article below to see how some scientists are using mold to create art.

I have been working with mycologists at Birkbeck College, London, developing artworks using fungi for a number of years. My first project was a work growing species of fungi that live on particular foodstuffs. To check the work met health and safety regulations, I took weekly air samples to monitor spore levels. It turned out that spores are ever present in the atmosphere, which, while perfectly obvious in hindsight, was not something I, or most people I spoke to, had thought about. Becoming aware of this, and learning about mycology, has fuelled a string of fruitful adventures.

The TwoTen exhibition went on tour, and since I had to work with labs to set up the work afresh for each venue, it led me into discussions with more micro-biologists and visitors. This has helped me channel ideas from this initial work into more ambitious ventures.

In 2002, I was invited to take up the inaugural Fine Art Fellowship at Massey University in Wellington, New Zealand, for six months, culminating in an exhibition at the National Museum of New Zealand Te Papa Tongarewa. I proposed to make a 'microbial portrait' of the North Island for the outside terrace on the top floor of the Museum, edged by 23 glass panels.

Did You Know...

Mould is an alternative spelling for mold, often used in the British Isles and other countries utilizing British English.

The formative ideas for my recent projects originated in the Wellcome Trust's TwoTen Gallery. In 2001, I was invited to contribute to 'Growth and Form.' the exhibition of biomedical images and contemporary artworks. I made 'Breathe' specifically for the gallery, using fungal spores from air samples taken in and around the Wellcome Building, and growing them on three giant 'Petri plates' of agar that were installed on light boxes as a 'live' work. My aim was to make visible a breath of air.

A fascination with fungi has opened up new artistic and geographical horizons.

I have traveled a great deal during the last two years, with my luggage increasingly coming to resemble a mobile laboratory. Pots of agar, culture plates, and various other paraphernalia accompany me on my trips. I never dreamt that fungi would take me so far, nor involve meeting such an unexpected range of people.

Breaking the Mould

Handout 5 — Breaking the Mould

Investigating the Fungus Among Us
A 4-H Educational Curriculum on Mold
The spectacular view from the terrace stretches across the curve of Wellington harbor, beyond the hills, and northwards across the Tararua mountains, drawing one's gaze to the distant horizon.

I mapped sight lines radiating outwards from the terrace across maps of the country, corresponding to the view through each panel. I visited locations that lay on each line, choosing places for geographic, cultural, historic or scientific significance, or sometimes simply because I was curious to know what lay behind a name, collecting spore-laden air samples as I went. Once cultivated, images taken of the samples were fixed to the glass panels, visually binding the geography of the site with the biology of the environment.

Last summer, I carried out a pilot project supported by Winchester School of Art and the Arts and Humanities Research Board, to explore the possibilities of 'mapping' the thin slice of land that is Chile, by way of the microbial content of its air. Chile has a unique range of climates, from the heat and aridity of the Atacama desert right down to the frozen wastes of Antarctica. So far, I have collected samples at latitudes from Africa in the far north [and] as far south as Santiago, at coastal and interior locations, passing through stark, breathtaking landscapes, and meeting some extraordinary people along the way. With generous assistance from the Museo Nacional de Historia Natural in Santiago and countless people in Chile and the UK, what began as a muttering of an idea has become very real.

For me as an artist, working alongside scientists propagates a practice that is informed and enriched by science rather than being illustrative. I like facts. Adding some knowledge of science to my work raises questions that I doubt would otherwise come to mind. I use a scientific methodology to gather my information and materials, but inject an artist's sensibility to articulate it.

I am hoping to return to Chile to complete the southern half of the country, but I also have my eye on Antarctica. Apsley Cherry-Garrard opens his account of Scott's final expedition to the South Pole with the lines: “Polar Exploration is at once the cleanest and most isolated way of having a bad time which has been devised.” I am determined to find out for myself.

For further information, you can contact Rachel Chapman at chapman@mistral.co.uk.
Investigating the Fungus Among Us
A 4-H Educational Curriculum on Mold

Lesson 3 — Science and Art of Mold
Activity 6 — Mold Master

**Target Age Range:**
Grades 5–8

**Life Skill:**
Data Collecting

**Subject Area:**
Science Skills

**Subject Matter Outcome:**
Youth will be able to:
- identify mold and the conditions which promote mold growth.
- identify areas that are prone to mold growth, both indoor and outdoor.

**Sunshine State Standard:**
LA.5.4.2.1

**Time Needed:** 2 days
One 45 min. period
Time at home
One 20 min. period for reflect/apply

**Materials Needed:**
Refer to the Materials Box next to each activity

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**ADVANCED PREPARATION**

**Create Boundaries.** The youth will need to have certain boundaries in which to perform their scavenger hunt. Investigate the area and determine the appropriate boundaries for your group.

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**INTRODUCTION**

Begin this activity by sharing these interesting moldy facts with the youth:

**Did You Know?**
- Molds carry their stomachs on the outside, unlike people, who digest food on the inside.
- Some molds have beneficial uses to us. Penicillin, the most common antibiotic, is derived from mold.
- Some cheeses, like blue cheese are supposed to be moldy. Blue cheese gets its flavor and name from the veins of the blue-green mold in it.

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**ACTIVITY 6 — MOLD MASTER**

(Youth observe the growth of mold)

Separate youth into small groups (2–3 students per group) and hand out the materials listed on the right.

Tell youth: **I've just passed out a handout. Using what you've learned about mold, you are going to prove you are becoming Mold Masters.** Explain the boundaries for the scavenger hunt you set.

Within the boundaries I have given you, find five examples of mold growth. Warn youth: **DO NOT TOUCH THE MOLD.** Just describe the location and what you see. You have 30 minutes.

Once youth return, ask one of the small groups to share their findings. As they present their findings, have the other groups look at their own findings and tabulate their score using the scale on the next page.
Repeat this process for all of the teams and locations. Have youth calculate their score to determine who is Master Mold!

Pass out another copy of Handout 3b for them to complete at home. Let youth know that the locations for their hunt are listed at the bottom of the handout. Location 1 covers the bedrooms, Location 2 covers any bathrooms, Location 3 covers the kitchen, Location 4 is the laundry room, and Location 5 looks at any rooms not listed above (garage, dining room, living room, etc.).

**MOLD MASTERS SCALE**

- If no one else found the same location, the presenting team gets 3 points.
- If another group found the same example, both groups get 1 point.
- If every group found the same example, no one gets the point.

**Now...**

**REFLECT**
- What was one of the locations that you found potential mold growth?
- What was it about that location that makes mold growth possible?
- What locations did you choose not to look in?
- Why did you think these areas would not have mold growth?
- Did any of the mold locations surprise you? Why?

**APPLY**
- Handout 6 is another scavenger hunt for you to perform at home. How will our findings today affect where you search at home?
- What did the areas where you found mold have in common?
- Were there any differences?

**EXTENSION ACTIVITIES**

Have youth perform the scavenger hunt using cameras (disposable or digital if available), taking pictures of the areas they found mold growth.

Have small groups create informational posters on mold growth in indoor and outdoor environments using the photos from above.
# Mold Master Scavenger Hunt

<table>
<thead>
<tr>
<th># of Moldy Locations</th>
<th>Describe the conditions that promoted the mold growth in that location.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 1</td>
<td></td>
</tr>
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<td>Location 2</td>
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<td>Location 3</td>
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<td>Location 4</td>
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</tbody>
</table>
| Total                | When You Look at Home: Location 1 = Bedrooms Location 4 = Laundry Room  
                      | Location 2 = Bathrooms Location 5 = Additional Rooms Location 3 = Kitchen |
# Mold Master Scavenger Hunt

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THE MEDICINE OF MOLD

This lesson examines medically-related molds, including the discovery and use of penicillin, as well as methods for treating the existence of molds in the home.

IN THIS CHAPTER...

The two activities in this chapter have been designed for exploration of mold propagation.

Activity 7: Mold Mitigation
- **Content Focus Area:** Theatre Arts
- **Life Skill:** Personal Safety
- **Desired Outcome:** Youth will be able to identify various methods for mold remediation/mitigation.

Activity 8: Moldy Medicine
- **Content Focus Area:** Health/Disease Prevention
- **Life Skill:** Personal Safety
- **Desired Outcome:** Youth will be able to identify benefits and dangers associated with mold products.

BACKGROUND BA-

Where's the Water Coming From?
Water damage to walls and ceilings is normally caused either by condensation, or by leaks and floods.

**Condensation**
In bathrooms, water damage from condensation is usually caused by hot, steamy showers and poor ventilation. To prevent this damage from occurring, time in the shower should be limited and the bathroom door or window should be kept open slightly while showering.

Condensation can often form on windows in cold weather and trickle down onto window sills and walls. To prevent the moisture from collecting, towels can be placed on the windowsills to absorb the excess moisture. These towels should be changed frequently and laundered with bleach.
Condensation can also form on A/C ducts above drop ceilings and then drip water onto the ceiling tiles. If ceiling tiles become damaged from water (condensation or leak) they should be promptly removed before serious mold growth appears. If brown, green, or black discoloration of ceiling tiles is evident, then proper steps for removal should be followed to prevent the present mold from spreading and contaminating the area.

Leaks and Floods
Three of the most common sources of water damage in the home result from some sort of leak: washing machine hoses, shower tile grout, and water heaters. Other common causes of water damage include floods, leaks in the plumbing or roof, and deterioration in mortar, seals or grout around the house. You must identify the cause of your water damage and have it promptly repaired. A single clean water leak does not usually cause a serious mold problem. However, if the leak is not promptly identified and repaired, and water damage is recurrent, mold growth can be expected. If this continues to be left unattended, toxic species of mold are likely to become prevalent throughout the damaged area.

Remediation (How to fix it?)
There are certain molds that are not safe to clean. This is especially true of black molds that have grown into the paper covering of sheetrock or any area of mold growth larger than 10 sq. ft. However, if the mold growth covers less than 10 sq. ft. and is limited to the painted surface of plaster and sheetrock, then clean up of this mold can be performed by following these instructions. The following protective devices are recommended:

- Mask—preferred: HEPA-filtered respirator; minimum: dust mask with 2 elastic straps and cinch-able nose piece
- Disposable gloves
- Cap to cover hair and ears
- Goggles—without holes to prevent airborne mold particles from getting in your eyes

In addition to your protective equipment, these cleaning supplies are also needed:

- Plastic spray bottles (2) – one for water, one for the bleach solution
- Bleach solution*—mix 10% bleach with water and a little dish soap
  *(Warning: NEVER mix bleach with ammonia.)
- Paper towels
- Trash bags
- Drop cloths (1–2, clear plastic sheeting)
- Duct tape or masking tape
- Ladder

Figure out how you will keep your possessions and the other areas of your home from also becoming contaminated during the mold clean-up. You may choose to empty the room before starting work, and then keep the door closed while working. If emptying the room is not possible, you can isolate the work area by taping plastic drop cloths to the ceiling so that it extends to the floor. This will create a barrier around the work area. Anything within the work area should be removed or covered with additional drop cloths. Following these instructions will help you avoid large amounts of mold released into the air, but some is unavoidable. That’s why it’s crucial that you wear the personal protective equipment listed above.
To clean moldy surfaces, other than a ceiling, thoroughly spray the surface with the bleach solution before doing any wiping. Wet particles do not fly well. Once wet, the surfaces should be wiped with paper towels. Place the paper towels into the trash bag, and repeat the process.

Since ceilings cannot be safely sprayed with the bleach solution without risking exposure to your skin and eyes, spray them with water and then wipe twice with paper towels that have been sprayed with the bleach solution. Place the paper towels into the trash bag and repeat the process.

Once you have finished cleaning the mold from the affected surface, all other surfaces within the work area should be wiped with the bleach solution and paper towels. Do not vacuum inside the work area since mold spores and bacteria will be released in the vacuum exhaust. Before removing the plastic sheeting and barriers, spray their inside surfaces with water, and then remove the barrier, folding the damp side inward. Dispose of used paper towels, plastic sheeting, and disposable masks, gloves and caps in a tightly sealed trash bag. Place the clothes you wore for the work into the laundry, and take a shower.

**Effects/Interactions (How do they affect us?)**

Molds can affect humans by causing decay and disease. They produce chemicals known as secondary metabolites, which can be harmful or beneficial. One type of metabolite, called mycotoxins, can be produced by many common molds that decay food, making the food unsafe to eat.

**Beneficial:** Some antibiotics are created from certain beneficial metabolites. They are useful because they are toxic to other microorganisms. The antibiotic penicillin, produced by many *Penicillium* species, is used against disease-causing bacteria. Cyclosporin A, produced by the fungus *Tolypocladium inflatum*, is widely used to help prevent human organ transplant patients from suffering from tissue rejection.

Molds have also provided benefits to the world of food since a variety of cultures use molds to create distinct flavors within their cuisine. Blue and camembert-style cheeses owe their distinctive flavor and coloring to various species of *Penicillium*. Molds related to black bread mold and *Aspergillus* species are used in the production of some Asian foods such as soy sauce.

**History of Penicillin:** Penicillin is a powerful broad-spectrum antibiotic. It was discovered in 1928, when Alexander Fleming's lab assistant left a window open overnight. This allowed mold spores to blow in on the wind and cover his bacterial specimens that were growing in a Petri dish. Thinking his specimens were ruined, he was about to throw the specimens away when he noticed something interesting. As he looked under the microscope at the bacteria, he noticed that many were dead or dying due to the mold presence. He identified the mold as *Penicillium notatum*. 
He did some testing on humans and animals and discovered that not only did it kill bacteria, but also that it was suitable for use in humans and animals. However, the discovery did not attract much attention until the 1940s when Howard Florey and Ernst Chain developed methods for mass production and application in humans. The timing proved valuable for the Allied forces during World War II. Due to its antibacterial nature, the penicillin created fewer incidents of death or amputation due to infection.

**Harmful:** Not all molds are beneficial. Molds can infect living organisms, causing irritating skin diseases such as ringworm and athlete's foot, or even severe systemic infections, which are common in some regions. Molds can also infect and kill insects and cause many plant diseases. To make matters worse, bacteria, such as Staphylococcus and other pathogens, often accompany mold.

Some people are quite sensitive to molds. For these people, exposure to molds can cause symptoms such as nasal and sinus congestion, eye irritation, wheezing, or skin irritation. Some people, such as those with serious allergies to molds, may have more severe reactions, including asthmatic reactions or upper respiratory infections. Severe reactions may occur among workers who are exposed to large amounts of molds because of their jobs, such as farmers working around moldy hay. Severe reactions may include fever and shortness of breath. Some people with chronic lung illnesses, such as obstructive lung disease, may develop mold infections in their lungs.
THE MEDICINE OF MOLD
Activity 7 — MOLD MITIGATION

Target Age Range:
Grades 5–8

Life Skill:
Personal Safety

Subject Area:
Theatre Arts

Subject Matter outcome:
Youth will be able to:
~ evaluate and identify the conditions that produce mold.
~ evaluate and identify the styles of remediation for mold problems.
~ create a game plan to deal with mold problems in their home.

Sunshine State Standard:
LA.5.3.2.1 TH.A.1.2.1
LA.5.3.2.2 TH.B.1.2.1
LA.5.3.2.3

Time Needed: 2 days
DAY 1: one 40 minute period
(for On Stage with Stachybotrys)
DAY 2: one 30 minute period
(for Mold Magazine); one 15 minute period (for reflect/apply)

Materials Needed:
Refer to the Materials Box next to each activity

ADVANCED PREPARATION
Gather Resources. Gather magazines (house-related) that have pictures of the interior/exterior of homes. Youth will use the images inside for their brochures.

INTRODUCTION
Tell youth: Most of you have completed the home survey by now. Did you find any possible mold contamination in your home? Allow youth to respond. Where did you find it? Allow youth to respond. What color was it? Allow youth to respond.

ACTIVITY 7 — MOLD MITIGATION
(Educates youth on mold mitigation)

Tell youth: The most common toxic mold, often called black mold, is the strain Stachybotrys. This mold is toxic because as the cells work, they create a waste known as a mycotoxin. These mycotoxins can pose serious threats to your health.

Separate youth into groups of 3–5. Give each youth the materials above. Have youth begin the activity: Now that you are aware of this potential health hazard, we need to figure out how to deal with it. Handout 7 has basic information about mold in your home. In your groups, read over the Handout. Then, as a group, create a skit where you demonstrate how mold can either be prevented or cleaned up if it has already occurred. Be creative! Give youth about 15 minutes to create skit and about 20–25 minutes to present skits. Separate youth into small groups (2–4).
MY MINI MOLD MITIGATION MAGAZINE
(Educates parents on mold mitigation)

Tell youth: Now, you need to share what we’ve found out about mold mitigation with your family. To do that, we are going to create a Mini Mold Mitigation Magazine. Include in your magazine: how mold grows and spreads, common places to find mold contamination, and how to deal with mold in your home (when you should treat it and when you should call a professional). Give youth the materials listed above and have youth begin the activity. Mitigation refers to any actions taken to improve site conditions by limiting, reducing or controlling hazards and contamination sources.

If this activity generates a great response, another great resource for this type of activity is Headlines for Health!, a new environmental hazards curriculum, available online at http://edis.ifas.ufl.edu/topic_series_headlines_for_health.

Now...

**Reflect**
- Was it hard to create a skit in 15 minutes?
- How did you determine which part each person would play?
- Are all molds poisonous?
- You created a Mini Mold Mitigation Magazine for your family. What was the hardest part of creating the magazine?
- Why do companies make magazines?
- How is a magazine similar to a newspaper? How is it different?

**Apply**
- What are the main differences between how to deal and how NOT to deal with mold problems at home?
- How can you use the information from this lesson to prevent your home from becoming a moldy mess?
- You had only 15 minutes to plan and perform a task. Why is it important to be able to think quickly and make a plan?
- What other areas of your life could you use this skill?

**Extension Activities**

Turn the information in your magazine into an informational poster for your school hallway, cafeteria, or media center.
Investigating the Fungus Among Us
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MOLD MITIGATION

WHAT ARE MOLDS?
Molds are types of fungi found both indoors and outdoors. They multiply quickly in warm, damp, and humid areas. Mold uses spores to spread and reproduce. These spores can survive conditions that do not normally support mold growth. This means that the spores stay dormant until the “right” conditions are introduced; then they begin to grow.

WHERE ARE MOLDS FOUND?
Molds can be found in almost every environment, both indoors and outdoors, year round. Molds prefer warm, humid conditions. They can be found in shady, damp areas outdoors such as places where leaves or other types of vegetation are decomposing.

Indoors, mold is often found in areas where moisture levels are high, like showers or basements. Mold can enter your home through open doors, windows, and vents. Mold in the air outside can also attach itself to your clothes, shoes, backpacks, or pets and be carried indoors.

Once the mold is in your home, it begins to grow in places with a lot of moisture. Bathrooms and basements aren’t the only problem areas. Leaks in roofs, windows, or pipes cause moisture to collect and make conditions right for mold growth. Mold grows well on porous materials such as paper products, cardboard, ceiling tiles, and on wood products, dust, paints, wallpaper, carpet, fabric, and upholstery.

SOME COMMON INDOOR MOLDS
- Cladosporium
- Penicillium
- Alternaria
- Aspergillus
- Stachybotrys

HOW MOLDS CAN AFFECT PEOPLE
Some people are sensitive to molds. These people may experience stuffiness or difficulty in their breathing, irritated eyes, coughs, or skin rashes. People who have serious allergies to molds may have more severe reactions which may include fever or extreme difficulty in breathing. People who have sensitivities to mold should stay away from areas that are likely to have mold, like compost piles, cut grass, and heavily wooded areas.

MOLD CONTROL
Use the tips below to decrease the possibility of your home becoming a moldy mess.

Prevention Tips
- Get a humidity detector (moisture meter) for your house. The humidity level of your house should always be between 40% and 60%.
- Use an air conditioner or a dehumidifier during humid months. These appliances take moisture out of the air and help maintain the proper level.
Prevention Tips (continued)
- Be sure your home has adequate ventilation, like exhaust fans in your kitchen and bathrooms. After a shower or bath, run the exhaust fan to help remove excess moisture from the air in the bathroom.
- Make sure your clothes dryer vents outside your home.
- Clean bathrooms with mold killing products.
- Do not carpet bathrooms and basements.
- Fix leaky roofs, windows, and pipes quickly once the problem is discovered.
- Be sure to clean and dry objects thoroughly and quickly (between 24–48 hours) after a flood. You should remove or replace any carpets or upholstery that have been soaked and cannot be dried within that period.

If your home has already become a moldy mess, you need to clean up the mold and fix the moisture problem. Use the tips below to deal with mold problems in your home.

Cleaning Tips

Small Areas (less than 10 sq ft)
- Mold can be removed from hard surfaces using one of the following:
  - commercial mold removal products OR
  - soap and water OR
  - a bleach solution (no more than 1 cup of bleach in 1 gallon of water) Note: If you choose to use bleach to clean up mold, NEVER mix bleach with ammonia or other household cleaners because this will produce dangerous, toxic fumes.
- Open windows & doors to provide fresh air.
- Wear proper attire: long-sleeved shirt, non-porous gloves, protective eyewear, and protective mask designed for particle removal.

Medium to Large Areas (more than 10 sq ft)
- Help from a professional mold remediation contractor may be necessary. If you choose to use a professional contractor, make sure they are certified, and have provided you with multiple references you can check to validate the quality of their work.

For more information, visit the EPA's site on mold at [http://www.epa.gov/mold](http://www.epa.gov/mold).
**Activity 8 — Moldy Medicine**

(Youth learn illnesses and cures associated with mold)

Separate youth into small groups (2–4). Give each group the following materials: Handout 8, shot cards, trigger cards, a pair of dice, and a unique token for each player.

Tell youth: **This board game has been created to show different medical benefits and issues associated with mold. In your group, play through this game.** This game will look at both the positive and negative contributions mold has made to medicine.

It is played with similar rules to the board game *Chutes and Ladders*. The object of the game is to be the first player to reach the Finish Line.
HOW TO PLAY: SHOTS AND TRIGGERS
1. Each player rolls the dice to see who starts the game. The player with the highest roll begins the game. The next player is the one who is to the right.
2. Players move one spot for every number rolled. If you rolled a four, you move four spaces. Each player only gets one roll per turn.
3. SHOTS: If a player lands on the BOTTOM of a SHOT, they draw one of the SHOT cards. Depending on the card they draw, they will either move up the needle or remain in the spot they are in.
4. TRIGGERS: If a player lands on the TOP of an ARROW, they draw one of the TRIGGER cards. Depending on the card they draw, they will either move down the arrow or remain in the spot they are in.
5. To win, the player must make an exact roll to land on the Finish Line.

Now...

Reflect
- What are the symptoms that can be triggered by mold growth?
- If you were to experience one of those symptoms, does that mean that you are sensitive to mold? Why or why not?
- What cures are created from mold?
- Have you used an antibiotic? Was it penicillin?
- Have your feelings about mold changed now that you know some of its positive attributes?

Apply
- How should you behave around people who are suffering from different illnesses?
- How can you reduce the possibility of you or your family experiencing mold-related symptoms?
- How can using something familiar, like a board game, help someone learn facts about topics like mold?

Extension Activities
Turn your favorite board game or puzzle into an educational game to help educate your family about the benefits and dangers of mold.
Penicillin made a major difference in the number of deaths and amputations due to infected wounds for Allied forces during WWII.

Use of penicillin began in the 1940s when Howard Florey and Ernst Chain developed a powdery form of the medicine.

Sir Alexander Fleming discovered the mold *Penicillium notatum* in 1928.
Australian scientist, Howard Walter Florey discovered medical uses for penicillin in 1939.

Commercial production of penicillin began in 1943.

In 1942, John Bumstead and Orvan Hess became the first in the world to successfully treat a patient using penicillin.

In the 1960s, scientists began creating semi-synthetic penicillin to deal with bacteria that had begun resisting penicillin.
<table>
<thead>
<tr>
<th>TRIGGER</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Water is dripping beneath the bathroom sink, but you forget to have your parents fix the problem.</td>
<td>Your bathroom window collects a lot of moisture after you shower, but you never wipe it up.</td>
<td>After walking through heavy vegetation in the woods near your house you notice your eyes beginning to burn.</td>
<td>You forgot to tell your mom to wear protective clothing when she cleaned up the mold in the bathroom.</td>
</tr>
<tr>
<td>Go Down the Arrow!</td>
<td>Go Down the Arrow!</td>
<td>Go Down the Arrow!</td>
<td>Go Down the Arrow!</td>
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<td>TRIGGER</td>
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</tr>
<tr>
<td>The vent for your clothes dryer does not vent outside.</td>
<td>You failed to turn on the exhaust fan after your shower to remove excess water from the air.</td>
<td>Your parents decided to put carpet in the basement.</td>
<td>You’ve recently noticed a funny “musty” smell in the garage along with small dark spots on the wall.</td>
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<td>Go Down the Arrow!</td>
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<td>TRIGGER</td>
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<tr>
<td>Water has collected under the bathroom sink, but you tell your parents about the problem. They clean it up and fix the leak.</td>
<td>Your bathroom window collects a lot of moisture after you shower, but you put a hand towel there to collect the extra moisture.</td>
<td>You know to avoid walking through heavy vegetation in the woods since you are sensitive to the mold that may grow there.</td>
<td>You reminded your mom to wear protective clothing (a mask and eyewear) when she cleaned up the mold in the bathroom.</td>
</tr>
<tr>
<td>Stay Where You Are!</td>
<td>Stay Where You Are!</td>
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<td>TRIGGER</td>
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<tr>
<td>You asked your parents to change the vent for your clothes dryer so that it will vent outside, removing the possible excess moisture.</td>
<td>You turn on the exhaust fan after your shower to remove excess water from the air in the bathroom.</td>
<td>Your parents want to change the floor in the basement. You remind them that carpet is a bad choice in the basement.</td>
<td>You notice a funny “musty” smell in the garage along with small dark spots on the wall and ask your dad to check it out.</td>
</tr>
<tr>
<td>Stay Where You Are!</td>
<td>Stay Where You Are!</td>
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<td>TRIGGER</td>
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</tr>
<tr>
<td>After recent heavy rains, water stains have formed on the ceiling tiles in your living room.</td>
<td>During the summer, the humidity in your house stays between 70% and 80%.</td>
<td>After heavy rains, water stains formed on the ceiling tiles in your living room. You fixed the leak and replaced the tiles.</td>
<td>Since humidity is higher during summer months, you use a dehumidifier to keep the humidity in your house 40% to 60%.</td>
</tr>
<tr>
<td>Go Down the Arrow!</td>
<td>Go Down the Arrow!</td>
<td>Stay Where You Are!</td>
<td>Stay Where You Are!</td>
</tr>
</tbody>
</table>
**SHOT**
You did a report on Sir Alexander Fleming, the scientist who discovered the benefits of the mold Penicillium notatum.
*Go Up the Syringe!*

**SHOT**
You were able to spell P-E-N-I-C-I-L-L-I-N during today’s spelling bee.
*Go Up the Syringe!*

**SHOT**
You forgot that penicillin wasn’t used as an antibiotic until the 1940s. Oops!
*Stay Where You Are!*

**SHOT**
You were able to list the possible symptoms of mold exposure during a recent quiz bowl.
*Go Up the Syringe!*

**SHOT**
It is estimated that 10-20% of people in the U.S. are allergic to penicillin. You find out that you are one of them.
*Stay Where You Are!*

**SHOT**
You are allergic to penicillin and develop hives from your prescription.
*Stay Where You Are!*

**SHOT**
Tell the recipe for the bleach solution to help you clean up mold in your home. If you can...
*Go Up the Syringe!*

**SHOT**
List three ways to deal with mold in your home. If you can...
*Go Up the Syringe!*

**SHOT**
It is estimated that 10-20% of people in the U.S. are allergic to penicillin. You find out that you are one of them.
*Stay Where You Are!*

**SHOT**
You notice symptoms such as wheezing, itchy eyes, and irritated throat after spending the month at your uncle’s farm.
*Stay Where You Are!*

**SHOT**
On today’s science test you missed the question about which conditions are favorable for mold growth.
*Stay Where You Are!*

**SHOT**
List three ways that mold spores can enter your home. If you can...
*Go Up the Syringe!*

**SHOT**
Tell the recipe for the bleach solution to help you clean up mold in your home. If you can...
*Go Up the Syringe!*

**SHOT**
List three ways that mold spores can enter your home. If you can...
*Go Up the Syringe!*

**SHOT**
Today, in history class, you learned that penicillin was used during World War II by Allied forces to help prevent wound infections.
*Go Up the Syringe!*

**SHOT**
List three ways that mold spores can enter your home. If you can...
*Go Up the Syringe!*

**SHOT**
Tell the recipe for the bleach solution to help you clean up mold in your home. If you can...
*Go Up the Syringe!*

**SHOT**
You get an infection after having your wisdom tooth removed, but the doctor prescribes Penicillin. You feel much better!
*Go Up the Syringe!*

**SHOT**
Name three possible symptoms experienced by someone who is sensitive to mold. If you can...
*Go Up the Syringe!*

**SHOT**
During a recent quiz bowl, you correctly named the mold specimen studied by Sir Alexander Fleming.
*Go Up the Syringe!*

**SHOT**
Name three possible symptoms experienced by someone who is sensitive to mold. If you can...
*Go Up the Syringe!*
Appendix A
Microscopic Images of Fungi

Aspergillus niger
(common black mold on certain fruits and vegetables)

Used with permissions from the Kaminski Digital Image Library at the University of Adelaide, Australia

Saccharomyces cerevisiae
(yeast, often used in baking and brewing)

Used with permissions from Wikipedia, public domain images.
Investigating the Fungus Among Us
A 4-H Educational Curriculum on Mold

*Rhizopus stolonifer*
(black bread mold)

Used with permissions from the Kaminski Digital Image Library at the University of Adelaide, Australia

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*Rhizopus stolonifer*
(black bread mold)

Used with permissions from the Kaminski Digital Image Library at the University of Adelaide, Australia
Penicillium chrysogenum
(common food and indoor mold)

Used with permissions from the Kaminski Digital Image Library at the University of Adelaide, Australia

Other Great Images

The Kaminski Digital Image Library at the University of Adelaide, Australia contains a wealth of images and PowerPoint presentations with these and many more images. To access these resources, visit http://www.mycology.adelaide.edu.au/gallery/kaminski/.
**Antibiotic** - any substance produced by a microorganism which harms or kills another microorganism.

**Classification** - the basic process of arranging into classes or categories.

**Condensation** - atmospheric moisture that has condensed because of cold (a decrease in temperature).

**Contamination** - the act of polluting including either intentionally or accidentally unwanted substances.

**Culture** - growing living cells or microorganisms in a controlled environment to get a desired result.

**Decomposer** - an organism that obtains nourishment by breaking down dead organic matter into a useable form.

**Enzymes** - proteins that trigger activities in the cells of the body. An enzyme is not affected by the activity that it starts.

**Filamentous** - long, cylindrical, and threadlike

**Fruiting Body** - the reproductive part of a fungus that contains or bears spores.

**Fungi** - molds, mildews, yeasts, mushrooms, and puffballs; a group of organisms lacking in chlorophyll (ie, are not photosynthetic) and which are usually non-mobile, filamentous, and multicellular. Some grow in soil, others attach themselves todecaying trees and other plants whence they obtain nutrients. Some are pathogens, others stabilize sewage and digest composted waste.

**Humidity** - the concentration of water vapor in the air.

**Hyphae** (singular - Hypha) - filaments that make up the body of a fungus.

**Leak** - an accidental hole that allows something fluid to enter or escape.

**Macroscopic** - visible to the naked eye

**Metabolite** - an organic product resulting from enzymatic reactions, including intermediate and waste products.

**Microscopic** - so small as to be invisible or indistinct without the use of a microscope

**Mildew** - a group of diseases caused by fungi and characterized by a white powder-like substance on the leaves. Often caused by poor air circulation around the plant or plants.

**Mitigation** - actions taken to improve site conditions by limiting, reducing or controlling hazards and contamination sources.

**Mold** (also spelled mould) - a type of fungus; molds are plants that make spores instead of seeds which float in the air like pollen. They are a common trigger for allergies. Molds are found in damp areas, such as the basement or bathroom, as well as in the outdoor environment in grass, leaf piles, hay, and mulch.

**Mycelium** (plural - mycelia) - the filamentous portion of a fungus, (excluding the fruiting structure or reproductive phase of the life cycle.) The mycelium may be invisible or conspicuous.

**Mycotoxin** - a toxin produced by a fungus; usually used to describe fungal metabolites that are toxic to man and/or animals.

**Nutrition** - the process of taking in and utilizing nutrients.

**Organic Material** - any material which started as a living organism.

**Organism** - a living thing that has (or can develop) the ability to act or function independently. Most living things...
- use energy;
- use food to sustain themselves and produce wastes;
- generally are made of one or more cells;
- reproduce;
- grow, change, or develop over time;
- interact with their surroundings;
- have a life span (a beginning and an end).

**Parasite** - an organism that lives in or on the living tissue of a host organism at the expense of that host.

**pH** - a measure of the acidity or alkalinity of a substance.

**Propagation** - spreading into new regions.

**Remediation** - cleanup of a site to levels determined to be healthy.

**Secondary Metabolite** - a chemical produced by a plant that does not appear to have a direct role in its growth.
The 4-H Motto

To make the best better.

The 4-H Pledge

I pledge

my head to clearer thinking,
my heart to greater loyalty,
my hands to larger service, and
my health to better living,
for my club, my community,
my country, and my world.

Visit the 4-H website for more information at http://www.florida4h.org.