



# The Fungus Among Us!

Teacher Resource Guide by Jake Benedict

## So, what is a fungus?

A fungus is different from a plant in that it is heterotrophic, which means that it does not produce its own food. Plants make get their own energy through photosynthesis and fungi rely on getting their energy from other sources such as dead plants and animals. Fungi are also different from plants because their cell wall is made of chitin. Chitin is the same material that insect's exoskeletons are made out of.

Fungus cells are different than animal cells because their cells have cell walls. Animal cells do not have cell walls, they have cell membranes. A cell wall is a hard structure that envelopes a cell, where a cell membrane is a fluid structure.

Fungi are also eukaryotic, which means that their cells contain a nucleus just like plant and animal cells do. Most fungi are multicellular, but some types, such as yeasts, are unicellular organisms.

Different types of fungi include:

- Yeast
- Molds
- Mushrooms
- Lichens\*
- Mildews

\*Lichens are normally made up of both plants and fungi, the green part is typically algae, a plant.

## Why should you care?

Fungi are in every aspect of our lives. They create much of the medicine we use, are in many of the foods we eat and help maintain the world we live in. Many do not realize the large role they play in everyday lives. Besides their well-known uses like penicillin, yeast and button mushrooms, fungi are used in cholesterol reducing medicines, citric acid, soy sauce, alcohol, blue cheese and paper making

production. Fungi's most important role is as a decomposer, an organism that breaks down dead matter. This helps to keep the earth free of excess dead material.

## Wait, I thought all fungi were mushrooms?

Mushrooms are basically some fungi's reproductive structures or fruiting bodies. Fruiting bodies are responsible for spreading fungi's spores. Fungi such as yeast do not produce fruiting bodies and other fungi such as the giant puffball do not make mushrooms for fruiting bodies, but instead produce the spore filled puffballs. Artist's conks are familiar fungi in the New York area (pictured right). Artist's conks are a form of very hard fruiting bodies that grow on the sides of trees that are not considered mushrooms.



## Fungi & Diseases

Fungi can both cause disease and cure disease. On the negative side, fungus can attack tissues like toes in Athlete's Foot, cause annoying Ringworm Infections and decay food like bread or strawberries. Others can cause diseases in trees like gall, which is basically an infected wound on a tree. Other fungi can cure diseases. Penicillin was discovered when a fungus killed off bacteria in a petri dish experiment gone wrong. Cholesterol lowering medications like Lipitor use fungi to make the medication.



## Fungus & Food

Humans eat fungi in many more ways than mushrooms. Bread is made using yeast, a fungus that provides the "lift" in bread making resulting in air bubbles in bread. Beer and wine both use fungi's alcohol producing properties in the fermenting process. Brie cheese, blue cheese and any rennet free dairy product are

made using fungi. Citric acid is made in a process using fungus. Citric acid is found in many of the foods we eat like sour candy, tomato sauce and soft drinks. Soy sauce is also made using fungi to ferment it.

## Fun Facts:

### How big can they get?

Portobello mushrooms may be the largest fungi many people have encountered, but there are many species far larger than it. Artist conches can reach sizes as wide as a 5<sup>th</sup> grader is tall. The largest known fungus in the world covers over 2,000 acres and is estimated to be over 8,500 years old! This cluster of honey mushrooms was discovered in Oregon when scientists realized every mushroom was genetically identical. It is widely considered to be the largest organism on the Earth. Some of the smallest fungi are the yeast cells that humans use as baking yeast. They are made up of microscopic, single cells.

### What is the most athletic fungus?

The pilobus fungi, which is deposited in cow dung has a unique challenge. In order to reproduce, it must send its spores far enough away from the poo so that a cow will eat it. The fungi can shoot its spores up to 16 feet away!



### What exactly was that Quorn stuff?



Quorn is a mycoprotein product. It is commercially available as a meat substitute and marketed as fake chicken nuggets, burgers and turkey. Mycoprotein is a fancy word for compressed fungus. Quorn is actually very nutritious and can supply much of a human's daily needs for protein. It is available at Tops and Wegman's.

## Further Activities:

### Make your own spore print!



Mushroom spores come in many different colors; it is actually a method mycologists use to differentiate mushroom species. Students can create their own spore prints using construction paper and a mushroom from the supermarket. Portabellas work nicely because of their size, but any mushroom with gills will work.

- Cut the stem off of the mushroom so that the cap is flat on the bottom.
- Place the mushroom, gill side down, on a piece of white construction paper and let it sit overnight.
- Lift the cap off of the paper gently to reveal the spore print pattern on the paper.
- The print can be preserved using spray lacquer or careful lamination.

### Parmesan Puffballs Recipe

Puffballs are common in yards across New York State. It is very hard to confuse a puffball with a poisonous variety so they are considered safe for amateur foraging. One thing to look out for is puffballs that have matured and are filled with black powdery spores- they are not so appetizing. The Earthball, which looks like a puffball from the outside is black in the middle and is also not something you would want to eat. Just look for large balls that are completely white on the inside.



Serves 4 as an appetizer



### Ingredients:

1 teaspoon salt

1 cup flour

About 1 pound puffballs, peeled and cut into 1/2-inch slices

1 egg, slightly beaten with 2 tablespoons water

1 cup freshly grated Parmesan cheese

4 tablespoons butter or more if needed

2 tablespoons oil or more if needed

### Procedure:

Mix the salt with the flour. Dip the mushroom slices in the flour, then in the egg, and last, in the cheese. Melt the butter and oil in a sauté pan or skillet and sauté the mushrooms slowly until golden brown. Drain on paper towels. Serve at once.

## **Additional Resources:**

*The Rotten World Around Us* a film by the BBC gives a fascinating introduction to the world of fungi and relates it to everyday life. It also has some incredible photography.

The University of Sydney in Australia has a great website:

<http://bugs.bio.usyd.edu.au/learning/resources/Mycology/contents.shtml> It has a very application-based approach to fungi and has some pretty interesting facts.

The University of Hawaii has a nice page on fungi and food

<http://www.botany.hawaii.edu/faculty/wong/bot135/lect16.htm> It has a pretty exhaustive list of the fungi we eat daily.



### Photo Credits:

<http://kotaku.com/308020/the-totally-real-mario-super-mushroom>

<http://cookeatshare.com/groups/mushroom-lovers-4>

<http://eats-time.blogspot.com/2010/12/chinese-sauces-and-seasonings-part-1.html>

<http://www.sciencephoto.com/media/13767/enlarge>

<http://www.cityam.com/news-and-analysis/premier-foods-cuts-debt-sale-quorn-division>

<http://www.anbg.gov.au/fungi/spore-prints.html>

[http://www.glenlivetestate.co.uk/ladder\\_hills.html](http://www.glenlivetestate.co.uk/ladder_hills.html)

<http://www.northland-paradise.com/mushrooms.html>