Mycology for librarians: everything you never wanted to know about fungus

Amanda Rinehart, Data Librarian
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Photo courtesy of Kathie Hodge.
Mycology 101

Circle of life
Microbes
Fungi
Reproduction
Types/classification
Spread
Food/habitats
Toxicity
Identification
Control
Book-eaters
Fun facts!

Photo courtesy of the Library of Congress
Molds, mildew, and mushrooms...

Mycology – study of fungus

Mold = common term, generally “fluffy” fungi on food
Mildew = common term, generally flat growing fungi
Mushrooms = fungi with fleshy, above-ground fruiting structure
Fungi = molds, mildew, mushrooms, and yeasts

Photo courtesy of Milliped
The Circle of Life...

You are here

Plants

Animals

Fungi

Protists

Bacteria

(um, stuff we haven’t figured out yet)

Image courtesy of David Hillis, Derreck Zwickil and Robin Gutell
Fungi and Yeasts and Bacteria, oh my...

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Photo courtesy of Dennis Kunkel. Copyright 2009 Dennis Kunkel Microscopy, Inc. (www.denniskunkel.com).
Fungi

- Hyphae/mycelia
- Spore/conidia

Chitin

*Helicosporium griseum* image courtesy of Cornell Fungi at Flickr.com
Ant image courtesy of Pedro Moura Pinheiro’
Shrimp image courtesy of Renee Comet
Lifecycle

Fungal lifecycle courtesy of Masur.
Fungal lifecycle courtesy of Masur.
Wheat Rust

Life Cycle of Puccina graminis

Photo courtesy of the Agricultural Research Service
Spore Types

*Aleuria aurantiaca*, *Ingoldian hyphomycetes*, *Aspergillus niger*, *Pestalotiopsis sp.*, *Phycomyces blakesleeanus*, truffle spores, images courtesy of Kathie Hodge.
Fungi sexual states

Ascomycota 41%
Deuteromycota 31%
Other Basidiomycota 21%
Mushrooms 6%
Zygomycota 1%

Sexual reproduction only
Asexual reproduction only
Sexual and asexual reproduction (two names)

Amanita phalliodes illustration courtesy of von Albin Schmalfuß.
Dissemination

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http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0003237

- Mechanical
- Air
- Water
- Insects/animals

Combine image courtesy of the US Agricultural Research Service.
http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0003237
Food...

Facultative heterotrophs—cannot make their own food, but under stress can take advantage of multiple food sources.

Saprophytic (eats dead things)
Parasitic (eats living things)
Symbiotic (mutual benefit)

Healthy wood photo courtesy of Constantin Sander.
Neotyphodium coenophialum in fescue leaf courtesy of the US Agricultural Service.
Degraded wood photo courtesy of Robert A. Blanchette and Joel A. Jurgens, University of Minnesota.
Temperature and Humidity

- Temperature growth is highly variable
- Indoor relative humidity below 70%

Relative humidity = ratio of water vapor to maximum possible water vapor

Influenced by:
  - air pressure (elevation)
  - moisture in the air
  - temperature
Basic Biology

- Large cells
- Hard cell walls
- Complicated and flexible lifecycles
- Distinctive spores, basis for classification
- Mechanisms to spread spores
- Flexible living and eating habits
Bad fungi

- Allergies, asthma (~5%)
- Infections
  - Superficial
  - Immune compromised
  - 4 outdoor human pathogens
  - Organic dust toxic syndrome
- Toxic compounds (mycotoxins)
  - Mushroom poisoning (~90% *Amanita phalloides* )
  - Large, relatively immobile molecules
  - Warfare “Yellow Rain”, aerosolized

*Amanita phalloides* illustration courtesy of von Albin Schmalfuß.
Black Mold

- Dematiaceae - 36 species
- ~ 50 Stachybotrys sp.

*S. chartarum* (*S. atra*)
*S. Chlorohalonata*

Infant pulmonary hemorrhage
1993-94
No causational evidence

Photos courtesy of Dennis Kunkel.
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Identification

• Microscope
  • Tape mount spores (colonies or spore trap)
  • View under 40X or 60X
  • Identify with key


Person at microscope photo courtesy of Bill Branson.
Identification con’t.

- Selective culture media
- Metabolic fingerprint
  - BioLog.com
- DNA


Biolog and 96-well plate image courtesy of Amanda K Rinehart. Stained DNA photo of Joseph Elsbernd.
Methods of eradication

- Physical removal
  - Flame, UV light, lasers
  - Scrubbing, removing fungal items
- Environmental dormancy (humidity, temperature)
- Fungicide/fungistatic
  - Fumigation - exclude oxygen (methyl bromide, ethylene oxide)
  - Surface protectant (iodine, copper, sulfur, organic compounds)
  - Systemic – many organic compounds (plants and animals only)
Some book eaters...

*Aspergillus* sp.

*Fusarium oxysporum*

Aspergillus sp. light microscope image courtesy of US Department of Health and Human Services.
Aspergillus sp. SEM image courtesy of US National Institute of Health.
Aspergillus alliaceus colonies photo courtesy of Ninjatacoshell.
Fusarium oxysporum light microscope image courtesy of Gerald Holmes, Valent USA Corporation, Bugwood.org.
Fusarium sp. colonies photo courtesy of estherase.
SEM Fusarium oxysporum spores courtesy of Amanda K Rinehart.
More cellulolytic fungi...

*Alternaria solani*

*Chaetomium globosum*

*Alternaria solani* light microscope image courtesy of Paul Bachi, University of Kentucky Research and Education Center, Bugwood.org.  
*Alternaria sp.* Courtesy of Ninjatacoshell.  
*Chaetomium sp.* light microscope images courtesy of Kathie Hodge.
And even more ...

*Penicillium notatum*

*Trichoderma sp.*

*Penicillium notatum* colonies photo courtesy of Crulina 98.  
*Penicillium sp.* Light microscope photo courtesy of Y_Tambe.  
*Penicillium sp.* SEM image courtesy of AJC1.  
*Trichoderma sp.* colony courtesy of Kathie Hodge.  
*Trichoderma harzianum* light microscope image courtesy of the US Agricultural Research Service.
Without fungi, we wouldn’t have...

- leavened bread, yogurt, soy sauce, miso, or any alcohol.
- food supplements and additives, such as carotene dye, B12, and citric acid.
- antibiotics such as penicillin cephalosporin, and griseofulvin (anti-fungal)
- statins for high cholesterol
- immuno-suppressants for organ transplants
Fun facts...

- The fungal cannon (*Pilobolus crystallinus*) is the fastest known organism in the world.
- The largest organism in the world is a fungus (*Armillaria ostoyae*); over 4 square miles wide and at least 2400 years old in eastern Oregon.
- St. Anthony’s Fire, a hallucinogenic disease and possibly the basis of the Salem Witch Trials, is caused by a fungus, *Claviceps sp.*
- You can make both paper and ink from mushrooms!

*Coprinus comatus* ink photo courtesy of Kathie Hodge.
Selected Resources


