

EEK! MOLD! HELP!

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Mold

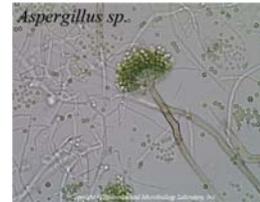
- What is it?
- Contributing factors
- Prevention
- Health hazards
- Response
- Recovery

What is Mold?

- Mold is everywhere and we cannot get rid of it!

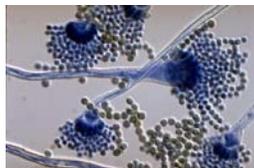
What is Mold?

- Mold is everywhere and we cannot get rid of it!
- Surface molds produce conidia (the spore carriers) AKA the instigator
 - *Aspergillus*, one of the most common species of mold
 - *Penicillium*, Penicillin (antibiotic); blue cheese
 - *Stachybotrys* AKA "(Toxic) Black Mold"



What is Mold?

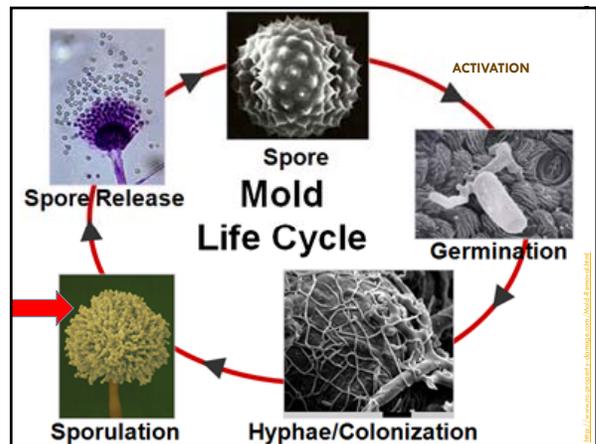
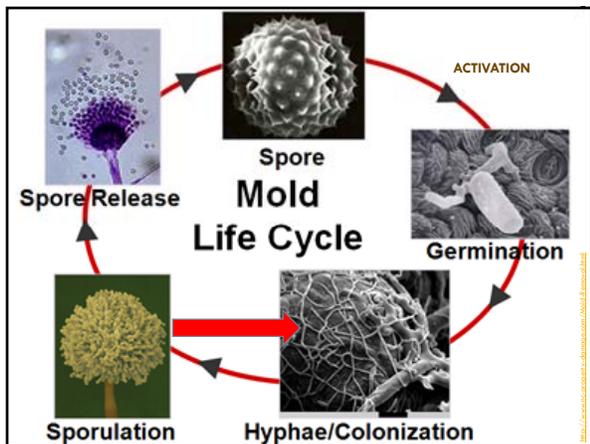
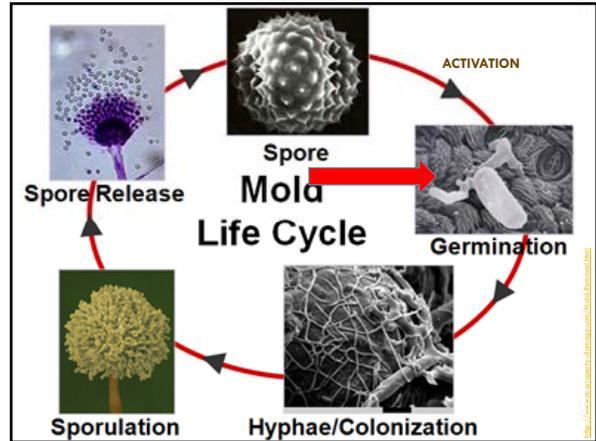
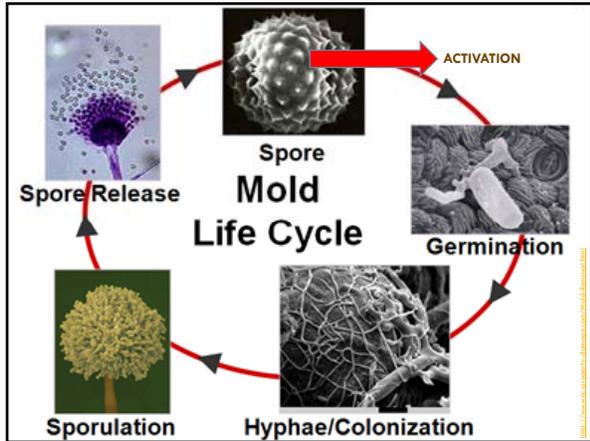
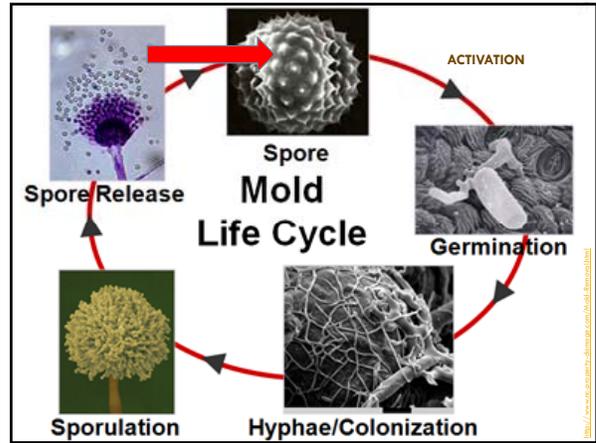
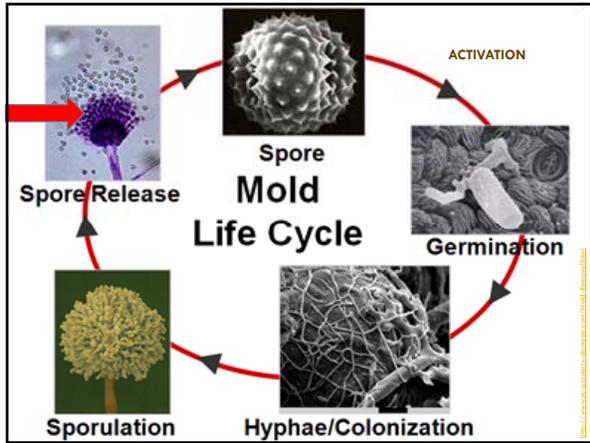
- Mold is everywhere and we cannot get rid of it!
- Surface molds produce conidia (the spore carriers) AKA the instigator
- The conidia and spores are specially designed for survival – they will only grow where they have a chance of survival (food and environment)



Aspergillus flavus

Spore Lifecycle

- Maturation and release
- Dormancy
- Activation
- Germination
- Hyphae
- Conidia formation
- ...and the cycle continues...



Spore Characteristics

- Dormant conidia and spores can survive extreme environments (freezing, dry, hot, etc.) but not once the conidia has been activated and germinated.
- Dormant conidia can remain viable for over 20 years, waiting for the right environment to germinate
 - REMOVAL is key

Mold in action!

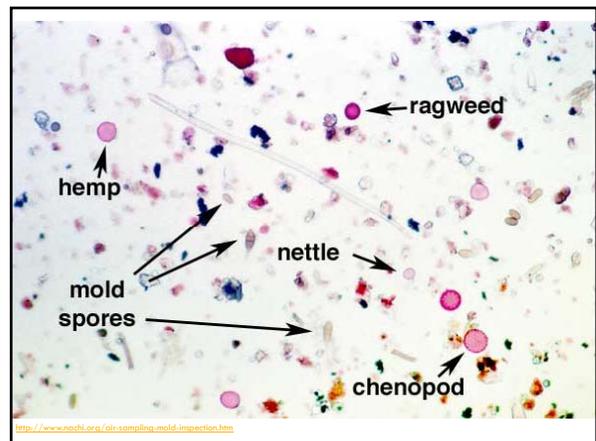
- *Rhizopus stolonifer*
 - AKA "black bread mold"
- The sequence spans 7 days with images made at 10 minute intervals

Mold in action!

- *Pleurotus ostreatus*
 - AKA "white oyster mushroom"
 - It's edible! Yum!
- Sequence spans 1 month 24 days

Sources of Spores and Conidia

- Airborne particles ranging in size from 1 -100 μm (1 μm = 1/1000 mm)
- Indoor mold growth on plants, dust, food, collections materials, etc.
- Contaminated collections through manufacture, use, or history

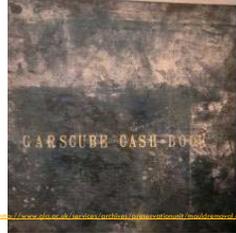


Active vs. Inactive Mold Growth

Active Mold Growth

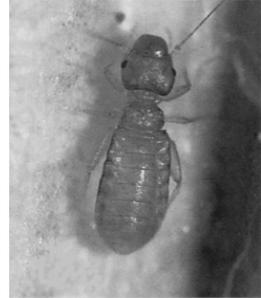


Inactive Mold Growth



Early Indicators

- Presence of insects
- Telltale odor

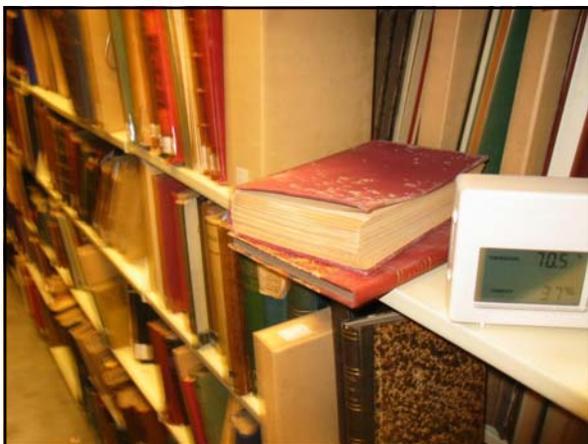


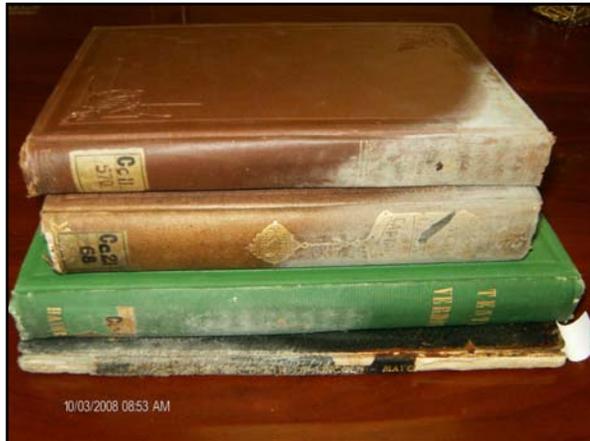
Booklouse (at high magnification)

<http://www.insectslimited.com/museum%20pest.htm>

Contributing Factors

- Microenvironments exist that can support mold
 - ▣ Behind shelves
 - ▣ Basement floor storage in cardboard boxes
 - ▣ Damp microenvironments due to location of water
 - ▣ Post water incident where drying did not take place immediately





Mold Prevention

- Get rid of excess moisture; reduce relative humidity and dew point!
 - Avoid storing collections in damp areas
 - Keep RH low (40-50%)
 - Ensure air circulation around collections
 - Respond quickly to water damage

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 - Respond quickly to water damage
- Materials that can hold more water than others are more susceptible
 - Hydrophilic (literally “water-loving”) materials

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- Regularly change air handler filters, clean ductwork if you have had a major outbreak
- Isolate and examine incoming collections
- Regular housekeeping to keep shelves and other surfaces free from dust
 - Use disposable static rags, like those from Swiffer, that have no additives and a HEPA-filtered vacuum

Infestation

- Mold will grow on everything and anything!
 - Different molds like different conditions and food sources
 - Primarily exterior (bindings, boxes, etc.) but also likely to be found on endpapers and in gutters of books and edges of papers in boxes.



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- Some molds are toxic to begin with, but only testing will tell
 - ▣ Stachybotrys ("black mold") is one of the toxic variants and usually grows on construction materials



Health Hazards

- All molds pose a health risk and some people are more at risk than others
- For people, mold is first a sensitizer which then becomes an allergen and then can later become toxic.
- Some molds are toxic to begin with, but only testing will tell
- Testing is the only surefire way to know if the mold is a "toxic" – and you have to test ALL of them



Response

- Confine the outbreak
- Stop the growth of the mold
- Kill the active mold growth
- Take steps to prevent re-infestation
- Ideally, response and recovery will be done by a vendor and not in-house!
- Do nothing until you have your Personal Protective Equipment (PPE)!

Personal Protective Equipment (PPEs)

- Gloves
 - ▣ Nitrile or Latex for handling collections
- Masks
 - ▣ Full- or half-face respirators (requires medical approval and fit testing) or N95/N100 particulate respirators (masks)
- Unvented goggles
- Protective clothing
 - ▣ Tyvek coveralls with or without feet or, at a minimum, aprons or lab coats

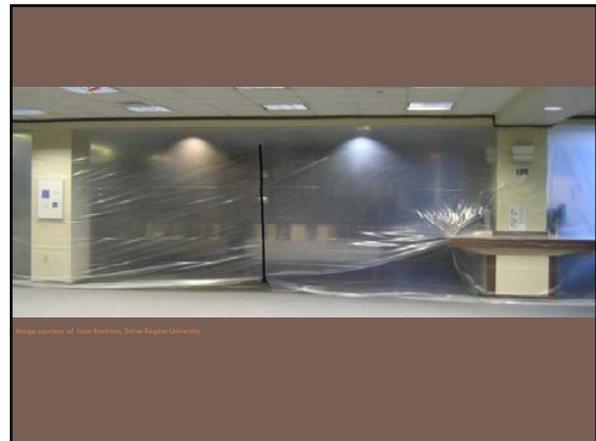


Is It a Dust Mask or a Respirator?

Dust Mask (not OK)	N95 Particulate Respirator (OK)
	

Confine the Outbreak

- For large incidents:
 - Isolate the area,
 - Create a negative pressure room to ensure the mold does not spread to other areas
 - This includes shutting down any air handling vents that may return air from the area.



Confine the Outbreak

- For smaller incidents:
 - Pack (wrap using Tyvek or spun polyester, use plastic bags only if the materials are not wet)
 - Move collection to a quarantine area.



Stop the Growth

- Dehumidification *in situ*
 - Does not require moving collections
 - Dropping temperature is not sufficient
 - If this is a water incident, as well as mold, air-drying will not stop inks from bleeding, coated paper will stick, and distortion of objects can occur
 - Old Wives' Tale: Sunlight does not kill mold



Stop the Growth, Kill the Mold

- Freezing
 - Growth stops and active mold killed
 - Buys time for decision-making and recovery preparations
 - Use caution when freezing museum objects.
 - Freezing and then air-drying can reactivate mold

Stop the Growth, Kill the Mold

- Vacuum Freeze-drying
 - Done by a vendor who can also then clean materials
 - Best for large outbreaks in libraries and archives



A Note on Fungicides

- Can have a deleterious effect on collections and people so only done if there is no other possible solution
- Some chemicals only stop growth, not kill the mold, these are called fungistats.
- Ethylene oxide will actually increase some material's susceptibility to future outbreaks
 - It is also a strong health and safety risk to people and is now banned in the EU.

Prevent Re-infestation

- Clean entire space, not just collections, with a HEPA vacuum, smoke sponge, and, if necessary, wipe down shelving with a solution of no more than 1 cup bleach per 1 gallon water. Dry thoroughly after wiping down.
- Replace any carpet, padding, furniture, wallboard, etc. that was moldy
- Repair or replace any equipment or plumbing that may have caused the problem
- Begin an environmental monitoring program



Collection Recovery

- Always assume there is a health hazard and wear PPE's
- The inactive mold will need to be removed from collections to ensure they are safe to use again, as well as to prevent re-infestation.
- Mold does physical damage to collections so any in-house cleaning should be done by trained staff with PPE's and a knowledge of careful handling techniques for fragile materials.

Cleaning Collections

You should not clean your collections by yourself, leave it for the professionals!

Cleaning Collections

- Only clean once the mold has been rendered inactive
- Mold stain removal is tricky business; leave it to the professionals
- Consider replacement as a viable option for some materials



Cleaning Collections

- HEPA-Filtered Vacuum
 - Once mold is inactive, it can be carefully cleaned off of collection materials using either a soft brush to direct mold into the nozzle or by vacuuming through a screen.
 - This should be done in a fume hood, in an isolated space with negative air pressure or outside on a still, sunny day to reduce the risk of spreading mold throughout the building.
 - Wear PPE's!



Cleaning Collections

- Smoke Sponge - "Gonzo" sponge
 - Works after vacuuming
 - Vulcanized rubber that traps the mold and dirt and is easily cut with a scissors
 - It can also drive mold into un-sized papers



Thank you!

Any questions, please contact me!

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