2021 Basic Aeroallergen Course

Fungal Spore Morphology

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THE UNIVERSITY of TULSA

VIRTUAL ANNUAL MEETING
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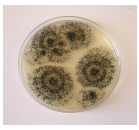
No conflicts to disclose

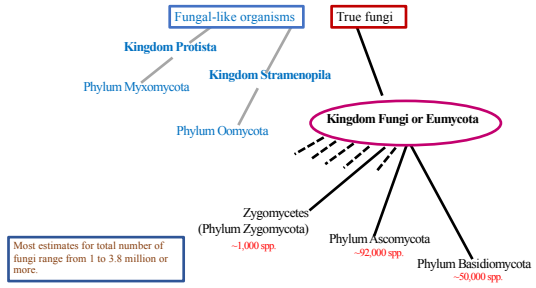
Fungi include:



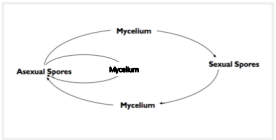



FUNGI AND FUNGAL-LIKE ORGANISMS

Classification

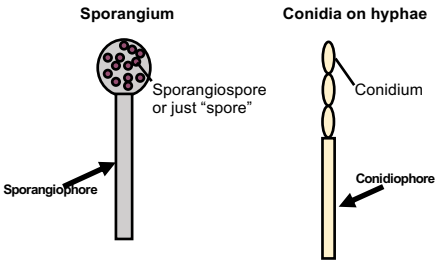


Fungi reproduce by spores

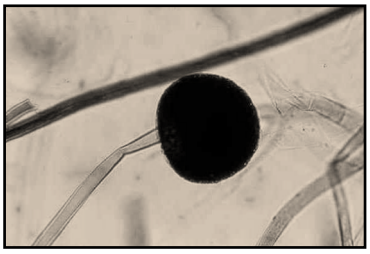



Spores can result from either sexual or asexual processes

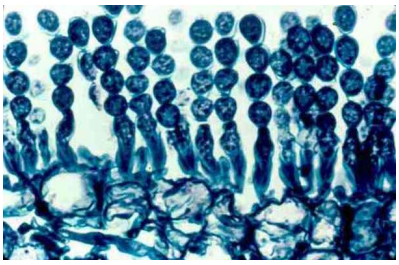
Types of asexual spores



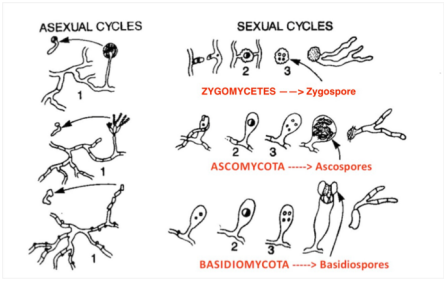
Rhizopus sporangium



Chains of conidia



Sexual spores form basis of classification



Spore release mechanisms

- PASSIVE: Frequently related to wind speed and turbulence – include members of the "Dry Air Spora" which peak in the afternoon
- ACTIVE: Generally require moisture – common mechanisms for ascospores and basidiospores
  - Basidiospores most abundant in predawn hours
  - Ascospores most abundant during or following rain; however, a number of ascospores only require high humidity and are abundant in predawn hours

Fungal Spore Characteristics

Characteristics

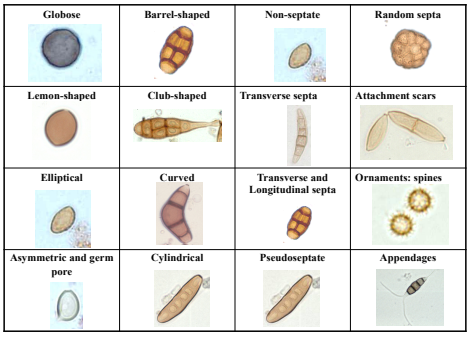
- Spore size
- Spore shape
- Number of cells
- Attachment evidence (scars, pegs, etc.)
- Wall characteristics
- Spore color

Spore Size, Shape, and Septation

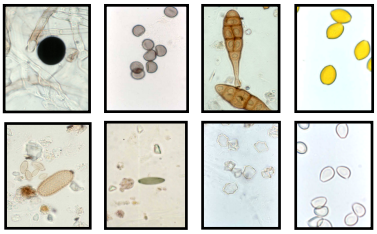
- **SIZE**: 2 µm to 100 µm
- **SHAPE**: Globose, elliptical, fusiform, asymmetric, lemon-shaped, barrel-shaped, curved
- **SEPTATION**: Non-septate (one cell), single septum, transverse septa, transverse and longitudinal septa, random septa, pseudoseptate

Other Characteristics

- **ATTACHMENTS**: Attachment scars, attachment pegs, other attachments OR no attachments
- **APPENDAGES**
- **WALL CHARACTERISTICS:** Smooth, granular, reticulate, spines, warts, wall thickness
- **COLOR**: Hyaline (colorless) to deeply pigmented



Spore color



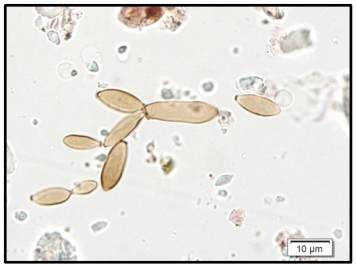
Phylum Ascomycota
Asexual Spores
or
Anamorphic Fungi

Previously known as
Deuteromycetes or Imperfect Fungi
THESE NAMES ARE OBSOLETE

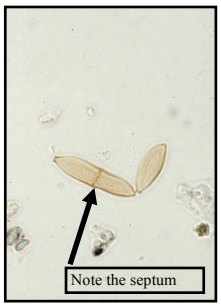
Asexual Spores

- Typically the most abundant spores in the atmosphere
- Conidia often formed on specialized hyphae called conidiophores
- Anamorphic (asexual) stage of ascomycetes
- Look for attachment scars (or other evidence of attachment) where the spores were attached to the conidiophore or to each other

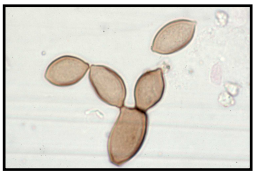
Cladosporium



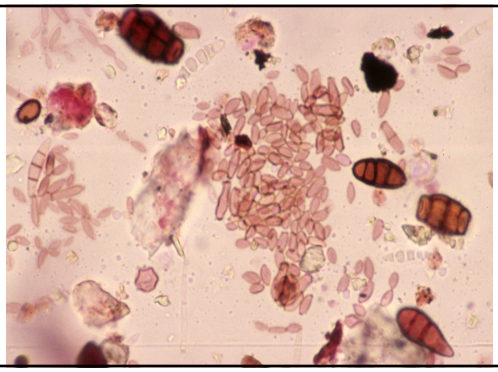
Cladosporium

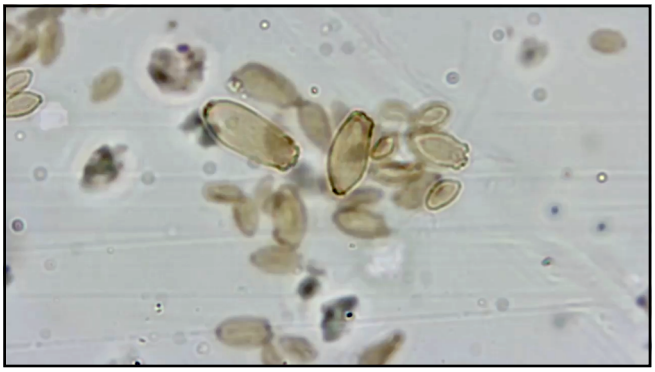


Several species of *Cladosporium* are common in the atmosphere



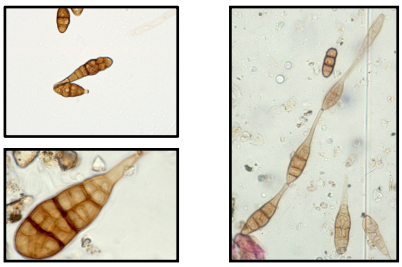
Note the prominent attachment scars on *Cladosporium* conidia

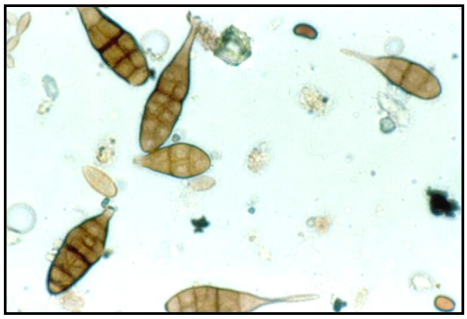




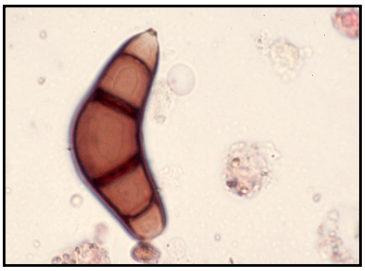
Alternaria

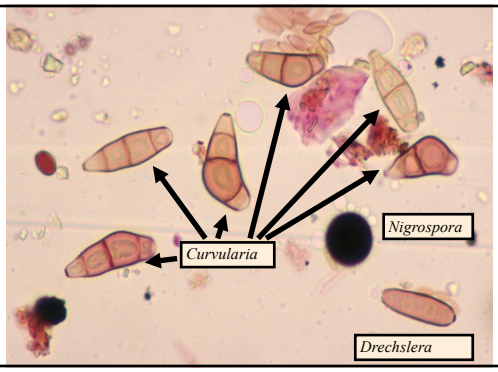
Alternaria





Curvularia





Drechslera-type spores

- Several genera of fungi have similar cylindrical spores
  - *Drechslera*
  - *Bipolaris*
  - *Exserohilum*
  - *Helminthosporium*

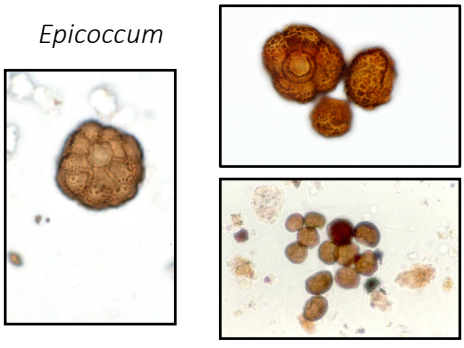
Drechslera-type spores

Pithomyces

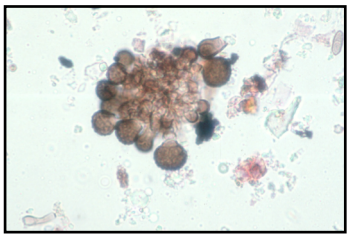
Note the colorless attachment at the base of *Pithomyces* spores

Pithomyces in culture

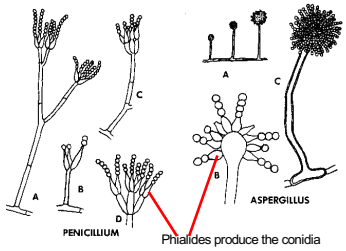
Epicoccum



Epicoccum spore cluster (sporodochium)



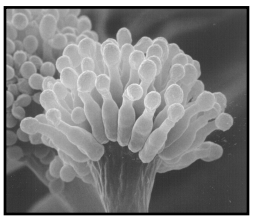
Penicillium and *Aspergillus*



Penicillium species

- Produce distinctive conidiophores (spore bearing structures)
- Spores are usually spherical to oval and form in chains

Aspergillus species



- Produce distinctive conidiophores (spore bearing structures)
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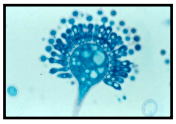
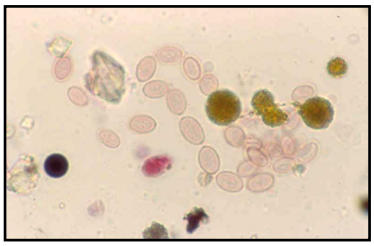
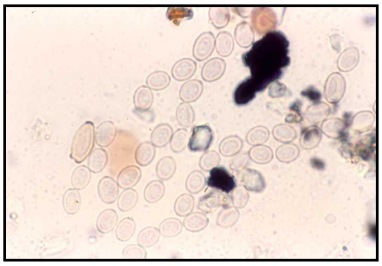


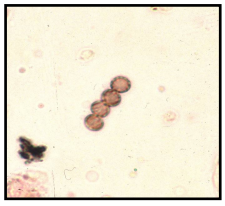
Penicillium-Aspergillus type spores



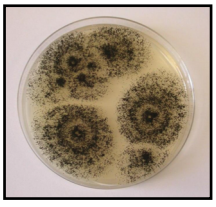
Penicillium-Aspergillus type spores

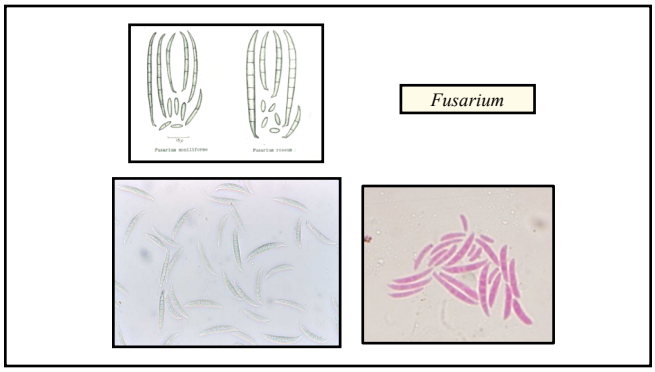


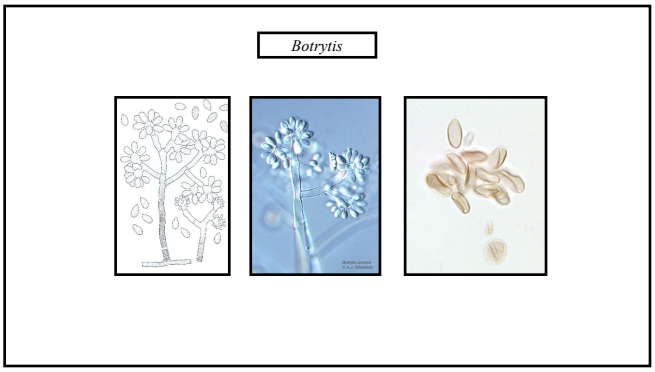
***Aspergillus niger* spores**

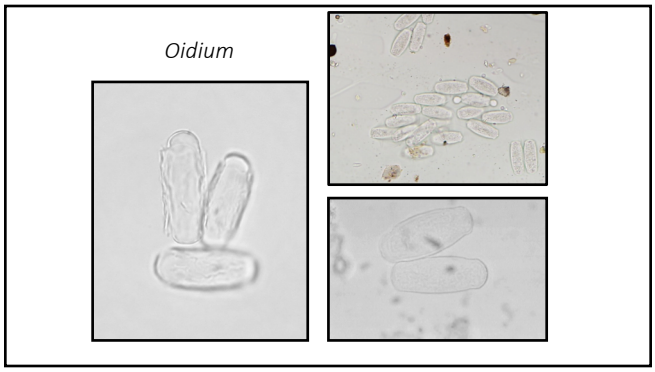


***Aspergillus niger* in culture**

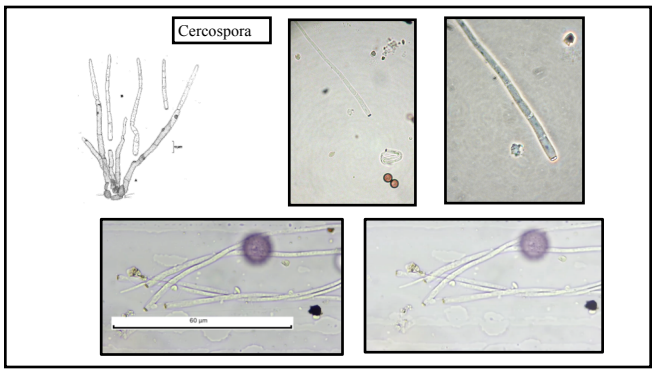


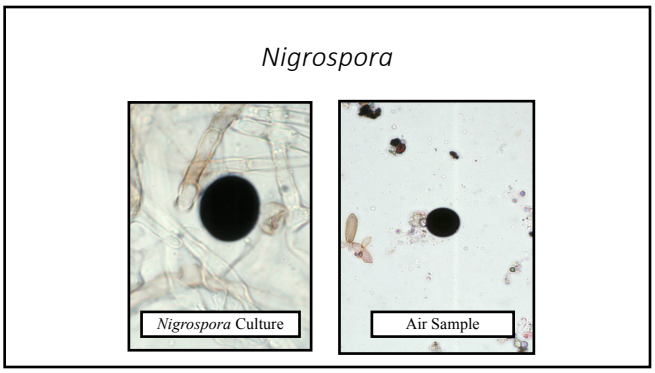

Fusarium

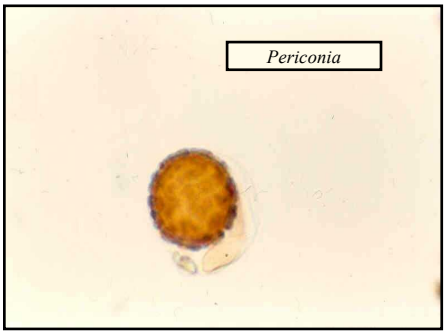

Botrytis

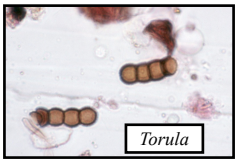

Oidium

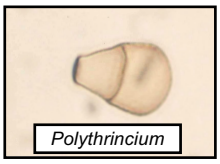

Other Asexual Spores on the NAB Spore List

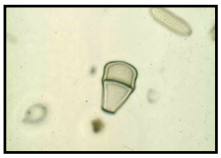

Cercospora

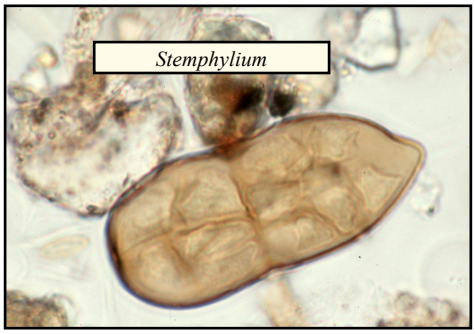

Nigrospora
Nigrospora Culture
Air Sample



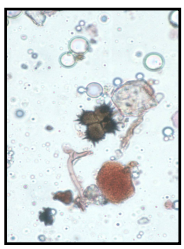




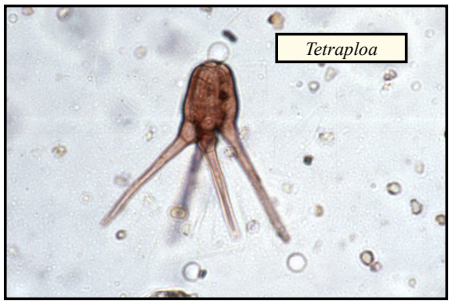




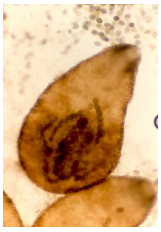
Spegazzinia



Arthrinium

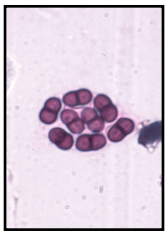


Phylum Ascomycota
Ascospores
(sexual spores)

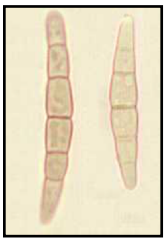


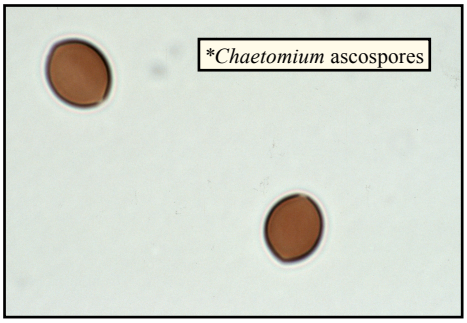
Eight ascospores are produced in each ascus without any attachment scars

Ascospores are sometimes found in groups of eight in air samples



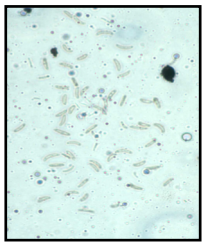
******Leptosphaeria* ascospores

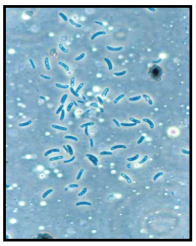




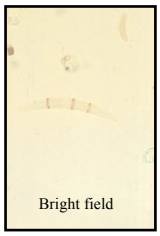
Pleospora ascospores

Diatrypella ascospores
(*Family Diatrypaceae)



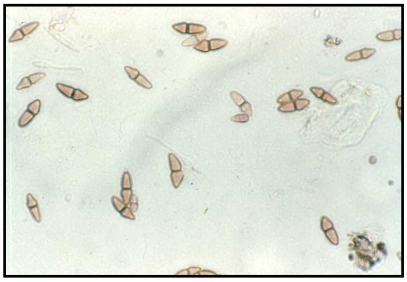


Phaeosphaeria annulata



Sporomiella ascospores

Venturia ascospores

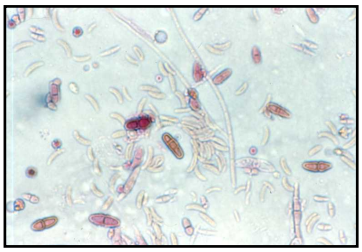


Paraphaeosphaeria ascospore

Leptosphaerulina ascospore

Various ascospores

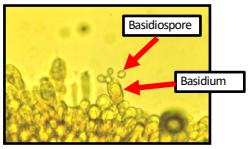
Many ascospores on a rainy day



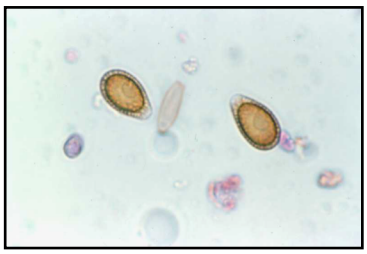
Phylum
Basidiomycota

Basidiospore characteristics

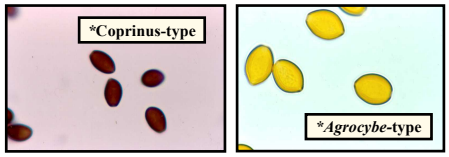
- Produced externally on basidia
- Single-celled
- Often asymmetrical shape
- Typically 4-12 µm in length
- Hilar appendage (*apiculus*) attaches spore to sterigma on basidium – hilar appendage often visible
- Completely colorless to deeply pigmented
- Germ pore present or absent

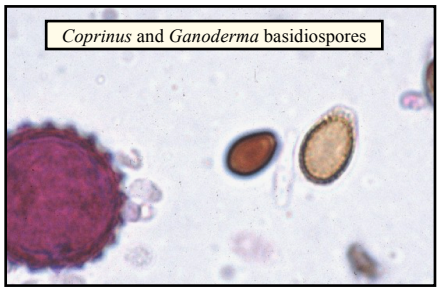


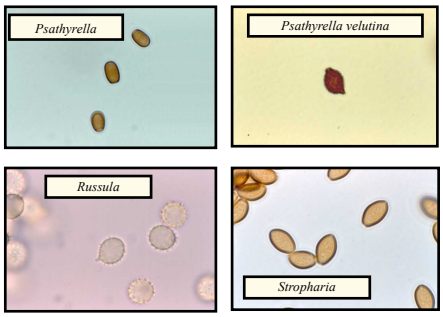
**Ganoderma* basidiospores

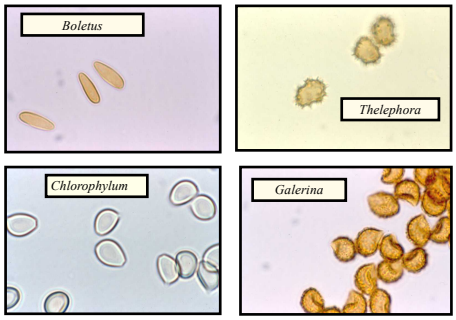


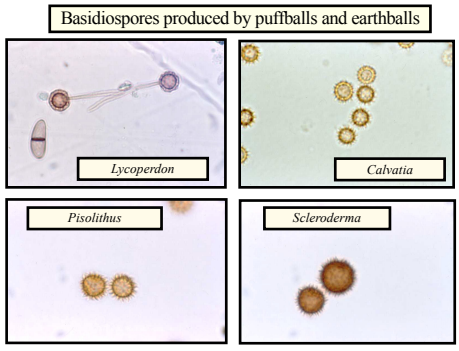
Other basidiospores that are easy to recognize



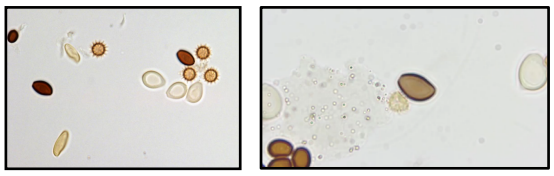






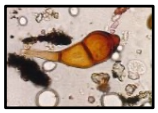


Mixed Basidiospores

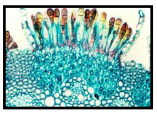


Rust spores

Puccinia uredospores

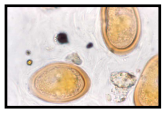


Puccinia teliospores



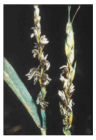
Teliospores on wheat

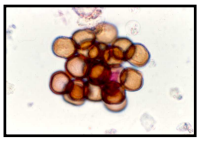
Other rust uredospores

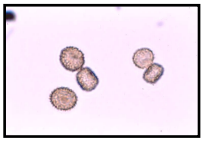


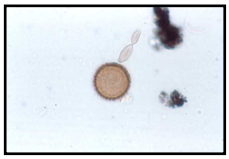
Other rust teliospores

Smut Spores



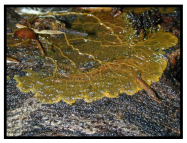


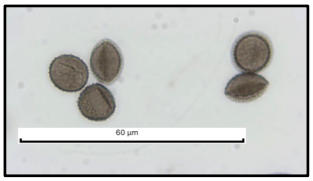




Smut Spores

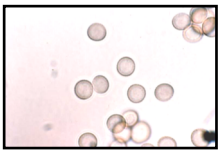
Myxomycetes (slime molds) are a group of fungal-like organisms which produce airborne spores





Currently, on the NAB spore list myxomycete spores are grouped with smut spores

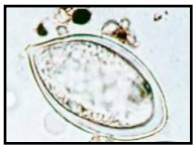
Other slime molds

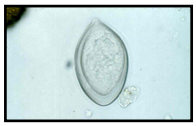


Peronospora

Fungal-like organism in Oomycota which is included on the NAB spore list

Peronospora on a sporangiophore





Peronospora spores in air samples