Dimorphism (two forms) is an important characteristic of certain fungal pathogens.

Mycelium ⟷ yeast

e.g. H. capsulatum

This conversion is temperature sensitive

Yeast form – at 37°c

Mycelial form – at 25°c

Dimorphism and pathogenesis

How does dimorphism function in the pathogenesis of mycoses ?

As an adaptation to the host environment, dimorphism improves a fungus's ability as a pathogen; for example:

H. capsulatum yeast forms survive after phagocytosis within alveolar macrophages and travel from the lungs via bloodstream into the spleen and liver.

Taxonomy / classification:

Kingdom Fungi

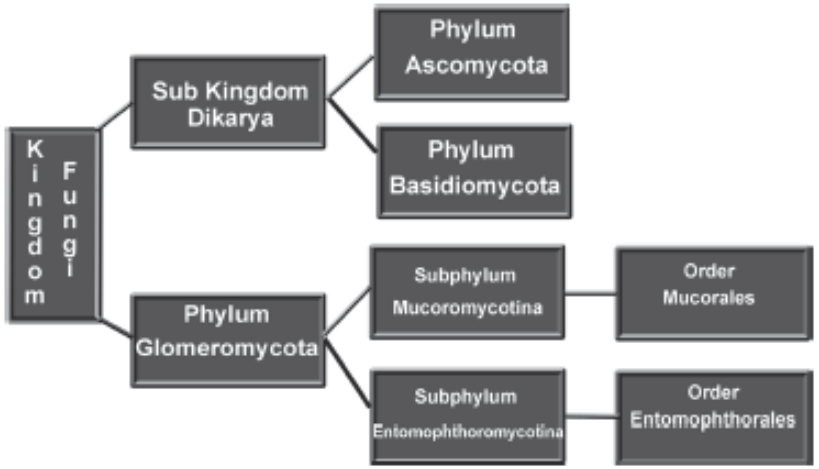
How are fungi organized in a taxonomic scheme?

The taxonomic classification of fungi is based on:

1. Mode of sexual reproduction
2. Morphology
3. Life cycle
4. Physiology
5. Cladistic analysis

If no sexual reproductive cycle has been observed, the fungi are referred to as mitosporic and are the further classified by cladistics analysis.

The higher level classification of Kingdom Fungi



A higher level classification of the kingdom Fungi: phyla and subphyla containing pathogenic fungi

The largest category of fungi pathogenic for humans is:

- Subkingdom Dikarya, consisting of two phyla: Ascomycota and Basidiomycota.
- (The familiar phylum zygomycota is not considered a valid taxon because it is not monophyletic).
- Fungal pathogens (previously in the zygomycota).

  Now found in subphylum Mucoromycotina and subphylum Entomophthoromycotina.

Primary pathogens

- Dimorphic fungal pathogens
- Found in specific geographic areas
- Endemic
- Have the capacity to cause infection in any individual (i.e. immune-normal or compromised)
- They are:
  - *Coccidioides* species
  - *Blastomyces dermatitidis*
  - *Histoplasma capsulatum*
  - *Paracoccidioides brasiliensis*
- Infection is initiated after the infectious conidia are inhaled when they are aerosolized by disturbance of the environment.

- Subcutaneous mycoses are also caused by primary pathogens.
- Initiate the pathogenic process ➔ wound skin.

Susceptibility to primary pathogens

- Immune normal persons are at risk.
  - Depends on a number of factors:
    1. Age
    2. Sex
    3. Race
    4. Physical health
    5. Immunologic status
    6. Number of infectious propagules inhaled

  Diseases caused by these fungi are not communicable
- Up to now, there are, no vaccine available for these diseases.

Opportunistic fungal pathogens

- May be common environmental molds (some yeasts), whose cells and conidia circulate in the aerospora

  e.g. *Aspergillus* species

  Cryptococcus species

- Adapted on the oral, intestinal and vaginal mucosae of humans and animals.

Susceptibility to opportunistic fungal pathogens

- Host factors:
  1. Immunocompromised status
     - HIV infection
     - Immunosuppressive therapy
     - Organs transplants

2. Immune normal host
   - Host factors that allow immune-normal persons to become susceptible to O.P. are:
     1. Age (low birthweight – premature infants; the elderly)
     2. Burns
     3. Chronic respiratory disease
     4. Debilitating illness
     5. Dialysis
     6. Endocrine disorders (e.g. diabetes mellitus)
     7. Surgery (e.g. cardiothoracic or abdominal)
     8. Traumatic injury

Determinants of pathogenicity

- Why are fungi pathogenic for humans ?
- Fungi use various stratagems to envade host defense.
- The list below is a summary of microbial factors that have been shown to influence pathogenicity:
  - Thermotolerance. Fungi that can grow at 37°c are potential pathogens in susceptible host.
  - Adaptation to parasitic lifestyle, sometimes in an intracellular environment.
  - Adhesins. Pathogenesis of microbial disease proceeds via adherence to host tissues, a process of receptor-ligand interaction.
  - Attack on host tissues using invasion promoting enzymes.
    - Secreted enzymes that damage host tissues for example:
      - Aspartyl proteinases
      - Phospholipases

- Dimorphism.
- Envasion of host immune defenses.
- Cell wall molecules are barriers that resist lysis by phagocytes and antifungal agents

  for example polysaccharide capsule of *Cryptococcus neoformans*

Source of infection:

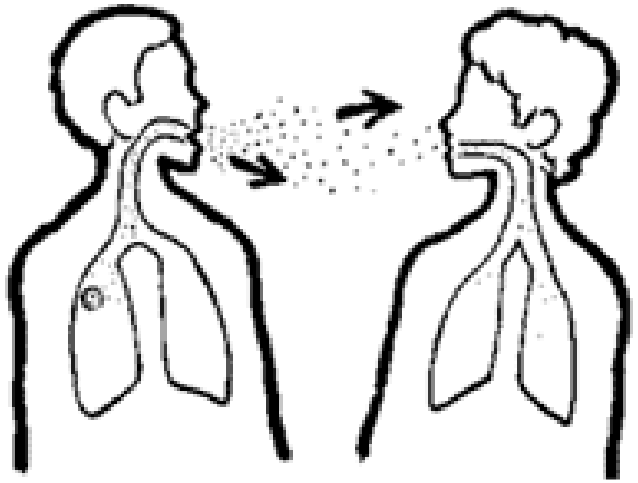
- **Endogenous:**
  - **Normal flora** and it is the main source in nosocomial infection (because those people in hospitals are **immunocompromized**).

Source of infection (cont.)

- **Exogenous:**
  - This is the main source of fungal infection mainly from the **environment**.
  - Few fungal infections are communicable between human or between animals.

Mode of transmission

- Respiratory tract (air borne infection).



- GIT (food & water borne infection).
- Blood stream injection.

- Skin = contact.

- Most fungal diseases are not communicable between human or animals.

Human mycoses

Several classification schemes for fungal infections has been employed. The classifications used in this section based on the primary site of pathology:

1. Superficial mycoses:
   - Infection restricted to upper most horny layer of skin, hair and nails. This site of infection is so superficial and the infection so innocuous that a response is not elicited.

     e.g. Pityriasis versicolor.

2. Cutaneous mycoses:
   - Infection of the skin caused by fungi are known collectively as dermatomycoses.

   The vast majority of such infections are caused by a related group of fungi known as dermatophytes and specifically known as dermatophytoses.

3. Subcutaneous mycoses:
   - Mycoses of implantation. Usually initiated by a puncture with thorn, twig or nail contaminated with a fungus, or the fungus will be introduced into the unclosed wound, in which melanized molds and their yeast-like relatives play an important role.

4. Systemic opportunistic mycoses:
   - Cover a wide range of etiologic agents and clinical forms caused by molds and yeasts (including environmental fungi and endogenous commensal fungi of the human microbiota.

5. Endemic mycoses:
   - Most are primary pulmonary pathogens affecting immune-normal as well as immunocompromised persons.