Chapter 1. Introduction to Fundamental Medical Mycology

Fig.1.1. Head of a child with tinea capitis (scalp ringworm). A 9-yr-old girl complained of cradle cap for over a year before developing itchy red patches on the right parietal scalp. She shed most of the hair in these areas. A culture was positive for *Trichophyton tonsurans*, and she was treated with oral griseofulvin with complete clearing of the tinea and regrowth of hair. Source: © Bernard A. Cohen, M.D., used with permission from Dermatlas; www.dermatlas.org

Fig.1.2. Sporotrichosis of the arm. Lesions draining each lymph node, from a primary lesion on the hand. Reproduced from Wilson and Plunkett, 1965 with permission from the University of California Press. Plate 5 (following page 54).

Fig. 1.3. Budding yeast cells of *C. albicans*; immunofluorescence stained with an anti-mannan mAb. Source: PHIL, CDC, E. Reiss

Fig. 1.4. *Candida parapsilosis* pseudohyphae. Source: redrawn from Fig 4, p 4, Haley and Rice, 1983.

Fig. 1.5. Microscopic view of septate hyphae: arrows point to septa. Source: H.J. Shadomy

Fig. 1.6. Radiating hyphae of a mycelium. Source: Dr. A.H.R. Buller (Buller,1931).

Fig. 1.7. a. Agar plate with mold colony: *Aspergillus fumigatus*. Source: Mr. Jim Gathany, CDC Creative Arts Branch.

Fig. 1.7.b. Agar plate with yeast colony. *Candida albicans* growing on SABHI agar. Source: Dr. William Kaplan, CDC.

Fig. 1.8. Broad aseptate hypha of *Rhizopus oryzae* in the histopathology section of a nasal mucosal biopsy from a case of rhinocerebral mucormycosis (GMS stain, 400 x). Used with permission from Dr. Uma M. Tendolkar, LTM Medical College, Mumbai.

Fig. 1.9. A higher level classification of the Kingdom Fungi: Phyla and sub-Phyla containing pathogenic fungi (Hibbett et al., 2007).

Fig. 1.10a. Form development of zygospore production. (1) Growth and attraction of branches of 2 compatible mating types; (2) Progametangia. The branches touch and their tips swell; (3) Gametangia. A septum forms between the gametangia and their vegetative hyphae; (4) Fusion of gametangia occurs with formation of the zygospore; (5) The mature ornamented zygospore. Genetic events which accompany sexual reproduction are displayed in Fig. 17A.2.

Fig. 1.10b. Zygospore with suspensor cells of *Syzgyites megalocarpus*. Used with permission from Dr. Gerald L. Benny, University of Florida, Gainesville, FL., website, www.zygomycetes.org
Fig. 1.11. Asci with ascospores, yeast in the Order *Saccharomycetales*. Redrawn from Wilson and Plunkett, 1965.

Fig. 1.12a. Cleistothecium of *Erisiphe* (*Microsphaera*) species, an agent of powdery mildew. The cleistothecium is ruptured showing transparent asci containing oval ascospores.  

Fig. 1.12b. Perithecium in longitudinal section, *Sordaria* species. 1. The peridium is the perithecium wall; 2. Asci and paraphyseal hyphae are the fertile layer of the ascoma: the hymenium; 3. Periphyseal hyphae provide a channel for escape of the ascospores through the 4. Pore or ostiole. Source: Used with permission from Dr. Robert L. Wick, Plant, Soil and Insect Sciences Department, University of Massachusetts, Amherst, MA.

Fig. 1.13. Sexual reproduction in a basidiomycete yeast: *Filobasidiella neoformans*. Inset: scanning EM of a basidium with basidiospores.  

1. Compatible mating type haploid yeast cells a and α secrete peptide pheromones that stimulate cell fusion (plasmogamy).
2. The resulting dikaryotic cell develops as a filamentous phase maintaining the dikaryon: the 2 parental nuclei migrate coordinately in the hyphae, divide, and septa separate the cells via clamp connections.
3. Later, the tip of the hypha enlarges into a round basidium.
4. Nuclear fusion (karyogamy) occurs in the basidium.
5. Meiosis occurs producing 4 haploid nuclei.
6. The haploid nuclei divide (mitosis) as they are packaged into basidiospores.
7. Basidiospores bud from the cell surface forming chains of basidiospores (These are infectious propagules).
8. Basidiospores disperse in air currents, germinate, producing haploid yeast cells.

Fig. 1.14. Dolipore septum of *Psilocybe cubensis*, present in all basidiomycetes. Transmission EM shows the following key features; 1. Dolipore swelling, 2. septal pore, 3. Pore plug, 4. Dome-shaped perforated parenthesome. Used with permission from Dr. Robert Simmons, Director, Biological Imaging Core Facility, Department of Biology, Georgia State University, Atlanta, GA.

Fig. 1.15. Ultrastructural features of the yeast cell visualized in a transmission EM depicting a cross section of yeast cell. CW, cell wall, PM, Plasma membrane, N, nucleus; V, vacuole, M, mitochondria.

Fig. 1.16. Organelles of the hyphal tip. 1. Septum with septal pore; 2. Woronin body; 3. Nucleus with nucleolus; 4. Rough endoplasmic reticulum; 5. mitochondrion; 6. cell membrane; 7. cell wall in 3 layers--inner layer-chitin, middle layer-glucan; outer layer-mannan; 8. tubular vacuole; 9. Golgi; 10. Spitzenkorper. Source: E Reiss