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## Volume Preface to the Second Edition

There have been major changes in our knowledge of the systematics and evolution of fungi since the first edition of the *Mycota*, Vol. VII. These changes have been driven by an outpouring of molecular phylogenetic analyses at first based on one or a few genes but now by multiple conserved genes. The Assembling the Fungal Tree of Life projects have been a major contributor to the data needed to construct the molecular phylogenies along with work from many additional labs. The resulting phylogenies have made possible a new taxonomic outline for the Fungi (Hibbett D.S. et al., 2007, *Mycol. Res.* 111: 509–547), which has provided a more stable systematic treatment for this kingdom, although some of the basal groups of Fungi remain incompletely resolved (Table 1). Agreement among many mycologists on nomenclature is providing a stable framework for Fungi that has been incorporated into reference works and online databases (McLaughlin D. J. et al., 2009, *Trends Microbiol.* 17: 488–497), and has provided an escape from the conflicting phenetic classifications of the past. These nomenclatural changes are incorporated into these volumes along with much new information on the evolution and ecology of these organisms made possible by a variety of methods, including environmental sequencing and reevaluation of character evolution using molecular phylogenies.

While there is agreement on nomenclature within Kingdom Fungi, there is less agreement on the names for groups of fungus-like organisms, although these organisms remain a major interest of those who study fungi. Some of the confusion arises from the treatment of fungus-like organisms under two nomenclatural codes (Table 1). Of special concern has been the treatment of the oomycetes and their relatives with variant spellings of the kingdom and common name. The solution adopted by Beakes (Chap. 3, Vol. VII, Part A) reserves *Straminipila* for the kingdom and uses the widely cited *stramenopiles* for the common name.

Chapters in this edition of the *Mycota*, Vol. VII, vary from updates of chapters published in the first edition to new chapters. All systematic chapters treat monophyletic groups; clearly polyphyletic groups, such as those based on yeasts or asexual stages (anamorphs), have been omitted. While authors have been encouraged to provide illustrations of the diversity within each group, the results are somewhat uneven. Some authors have extensively illustrated the organisms, while others for reasons of time or access have provided limited illustrations. In the interest of getting these chapters to press in a not too tardy manner, the authors have not been unduly pressed to add illustrations. The reader's understanding is requested for the omissions, which is caused in part by the difficulty of getting all of the chapters needed to cover a wide spectrum of organisms.

**Table 1** Taxonomic outline for Fungi and fungus-like organisms<sup>a</sup>


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*Fungus-like organisms*

Supergroup: Amoebozoa  
 Phylum: Dictyosteliomycota  
 Phylum: Myxomycota

Supergroup: Excavata  
 Phylum: Acrasiomycota

Supergroup: Sar<sup>b</sup>  
 Subgroup: Rhizaria  
 Phylum: Phytomyxea

Kingdom: Straminipila<sup>c</sup>  
 Phylum: Labyrinthulomycota  
 Phylum: Hyphochytriomycota  
 Phylum: Oomycota

*Fungi*

Supergroup: Opisthokonta  
 Kingdom: Fungi

*Basal fungi*

Phylum: Cryptomycota<sup>d</sup>  
 Phylum: Microsporidia

*Traditional Chytridiomycota*

Phylum: Chytridiomycota  
 Phylum: Monoblepharidomycota  
 Phylum: Neocallimastigomycota  
 Phylum: Blastocladiomycota

*Zygomycotan (Zygomycetous) Fungi*

Phylum: Entomophthoromycota  
 Phylum/a incertae sedis:  
 Subphylum: Kickxellomycotina  
 Subphylum: Mortierellomycotina  
 Subphylum: Mucoromycotina  
 Subphylum: Zoopagomycotina

Phylum: Glomeromycota

Subkingdom Dikarya

Phylum: Basidiomycota  
 Subphylum: Pucciniomycotina  
 Subphylum: Ustilaginomycotina  
 Subphylum: Agaricomycotina

Phylum: Ascomycota  
 Subphylum: Taphrinomycotina  
 Subphylum: Saccharomycotina  
 Subphylum: Pezizomycotina

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<sup>a</sup>Names for Fungi and fungus-like organisms traditionally studied by botanists are governed by the *International Code for Nomenclature of algae, fungi and plants (Melbourne Code)* (McNeil J. et al., 2012, Regnum Vegetabile 154, Koeltz Scientific Books). Multiple names exist for eukaryotic microorganisms that are treated under both the Melbourne Code and the International Code of Zoological Nomenclature, except for Microsporidia, which are classified under the zoological code

<sup>b</sup>Sar (Stramenopiles, Alveolata, and Rhizaria)

<sup>c</sup>Also known as Stramenopila or Stramenopiles. The latter is used by Adl et al. (2012, *J. Eukaryot. Microbiol.* 59: 429–493) and as a common name, stramenopiles, for Straminipila

<sup>d</sup>Also known as Rozellida and Rozellomycota

The Mycota, Vol. VII, includes treatments of the systematics and related topics for Fungi and fungus-like organisms in four eukaryotic supergroups (Table 1) as well as specialized chapters on nomenclature, techniques, and evolution. Most Fungi and fungus-like organisms are covered, including the Microsporidia. Chapter 1, Vol. VII, Part A, provides an overview of fungal origins and evolution.

Chapters 2–4, Vol. VII, Part A, cover the fungus-like organisms, and Chaps. 5 to 14, Vol. VII, Part A, and Chaps. 1–6, Vol. VII, Part B, cover the Fungi. Each of these chapters covers approximately the following topics: occurrence and distribution, economic importance, morphology and ultrastructure, development of the taxonomic theory, classification, and maintenance and culture. The fungus-like organisms are distributed in three distantly related supergroups (Table 1). The basal fungi and traditional Chytridiomycota are treated as six phyla and covered in four chapters, including Chap. 1, Vol. VII, Part A. The zygomycetous fungi, whose deeper relationships remain unresolved, and Glomeromycota are covered in two chapters. The Basidiomycota and Ascomycota, the largest groups of fungi, are treated in five or six chapters each. In the Basidiomycota two chapters cover Pucciniomycotina and Ustilaginomycotina, respectively, while three chapters are devoted to classes of the Agaricomycotina. In the Ascomycota a single chapter covers Taphrinomycotina and Saccharomycotina, while eight classes of the Pezizomycotina are covered in five chapters.

The following topics are treated in Chaps. 7–11 in Vol. VII, Part B: Chap. 7 deals with the nomenclatural changes necessitated by the recent changes to the International Code for Nomenclature of algae, fungi, and plants (Table 1), including the elimination of separate names for anamorphic fungi. Chapter 8 deals with methods for preservation of cultures and specimens, while Chap. 9 reviews the phylogenetic implications of subcellular and biochemical characters and methods for ultrastructural study. Chapter 10 deals with the fungal fossil record and Chap. 11 with the impact of the availability of whole genomes on studies of Fungi.

We are entering a new era in the study of fungi with whole genomes becoming available for an increasing number of species across all the known clades of Fungi. This genome-enabled mycology will utilize large numbers of genes in phylogenomic analyses to resolve difficult to determine relationships in fungi and to provide insights into fungal biology (Hibbett D.S. et al., 2013, *Mycologia* 106: 1339–1349). Initial studies are already having a significant impact on our understanding of biochemical processes and their ecological impacts. In time genomic studies may shed light on the genetic processes and the genes that control the great morphological diversity in Fungi from the subcellular to the macroscopic level. Thus, there is much new information on the systematics and evolution of fungi to be expected in the future.

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