
Preface

Twenty years ago, I wrote the first edition of this book on the fungal cell wall structure and synthesis, a topic in which I have been interested for many years. As occurs in *Twenty Years After*, second in the saga of *The Three Musketeers*, by Alexander Dumas, many changes have occurred during this 20-year time period, beginning with those occurring in my own person. The field of cell wall research is no exception, and the main topics of investigation have oscillated from those mainly centered on the determination of the chemical composition of the wall, and the biochemical and physiological aspects of cell wall growth and expansion, to a field dominated, in great part, by molecular biology and its ramifications. This change is obvious, since it is the wave in biology in general. It is positive because it has brought light to many aspects of the behavior of the cell wall, the synthesis of its main components, and the enzymes involved and their regulation. However, it is negative because many important aspects have been left out because they are not fashionable.

With this background, I have dared to take the responsibility of writing this second edition, maybe without taking into consideration that I am probably old-fashioned and perhaps without the necessary background to tackle the new ideas on the subject. But, with the courage to engage in an attractive enterprise and my long interest in the fungal cell wall, I expect to cover these deficiencies. Only the readers will judge if I have succeeded or not.

The cell wall is an attractive subject of study from many points of view, mainly because it is the structure responsible for the way of life of a large number of phyla; bacteria, fungi, algae, and plants, that is completely different from the animals and related wall-less organisms, with regard to mechanisms of nutrition, mobility, the capacity to colonize distinct ecological niches, and so forth. The appearance of the eukaryotic wall, completely different from the prokaryotic one, was a giant step in evolution that also marked the departure from wall-less organisms. This process was followed by the acquisition of walls with different composition by fungi, a process that separated them from plants and algae, and later, by the specialization of the fungal enzymes involved in the synthesis of the different components of the cell wall from the several groups of these organisms. These processes can now be analyzed using the modern phylogenetic, genetic, and *in silico* tools. The chemical characteristics of the different components of the cell wall can also be approached now with modern analytical procedures of extremely high sensitivity. The knowledge of the mechanisms of action and interaction of the enzymes involved in the synthesis of the wall components is now within our reach with the advent of techniques for gene isolation and mutation, and the concepts introduced by synthetic biology. Modern cytological procedures, the use of fluorescent probes, and new microscopic techniques have added excellent results to our knowledge of the location, displacement, and deployment of enzymes and organelles involved in wall growth.

All these concepts have made a great impact on the applied aspects of mycology; our knowledge of the bases of fungal pathogenicity to both man and animals and plants, where the wall plays an important role, the ecological importance of fungi, and the use of fungi in the production of a great number of compounds with important applications.

With all this acquired knowledge, it is surprising that many aspects related to the fungal wall remain either unknown or untouched: isolation and structural analyses of chitin and β -glucan synthases; mechanism of β -1,6-glucan biosynthesis; detailed physical structure of the cell wall; mechanical properties of the cell wall and their relation to wall growth and expansion; mechanisms of association of *moonlight* proteins into the wall; the development of specific antimycotics based on chitin inhibition, and so forth.

This book has been divided into chapters with almost the same topics as the first edition to try and allow those readers interested in only some selected aspects of the general subject to read them as separate reviews. In the first chapters, I present a review of the chemical composition and structure of the fungal cell wall, a matter almost closed to modern research. These chapters are followed by chapters describing the structure and synthesis of the most important components of the fungal cell wall. The last chapters are devoted to the analysis of the mechanisms of cell wall expansion and growth. For the sake of completeness, I have provided brief introductions on the basic concepts from which our modern ideas originated, citing older publications where necessary.

José Ruiz-Herrera
Irapuato, Mexico