

Geschichte der Mikrobiologie

HANS GÜNTER SCHLEGEL

1999. Deutsche Akademie
der Naturforscher
Leopoldina, Halle (Saale)

(Acta Historica Leopoldina, 28)

280 pp. 24.6 × 17.7 cm
ISBN 3-8304-5010-9

A trend of current scientific research is to focus especially on applied aspects of science that can produce quick benefits. This is what society demands, no matter one likes it or not. With this prospect, one appreciates having the possibility of looking back at other times, when scientists only aimed at quenching their thirst for knowledge, far from the pressures exerted nowadays by multinational companies, universities and other research institutions. Hans Günter Schlegel, Göttingen University, is a most brilliant German microbiologist, whose work has changed the whole field of microbial autotrophy. Besides his many research papers, he has written or edited several significant books on both general microbiology and biology of autotrophic bacteria. We are fortunate that his retirement has allowed him to delve into the past, browsing among books and documents, to produce the excellent book we are now reviewing. Through the pages of *Geschichte der Mikrobiologie* (History of Microbiology), the reader gets acquainted with researchers that set up the foundations for microbiology, usually with the only help of their brilliant minds and imagination. Since Antonie van Leeuwenhoek (1632–1723) wrote his first letter to the British Royal Society, describing the “very little animalcules” that he had seen by peering through his handmade—and homemade—microscope, things have changed a lot. It is amazing that such a simple instrument as Leeuwenhoek’s light microscope allowed him to unveil an unknown microcosms. The meticulous drawings and accounts of his observations are a proof of his achievements. Schlegel can imagine how the eyesight of the first pioneer microscopist may have ended after years of observations in the precarious conditions of those times.

The author has not followed a chronological order for the chapters. Each one deals with a specific topic, and makes an account of the development of ideas and knowledge on the subject over time. This strategy allows the reader to follow through the story and the controversies between opposite ideas in their historical contexts. “The discovery of bacteria”, “culture

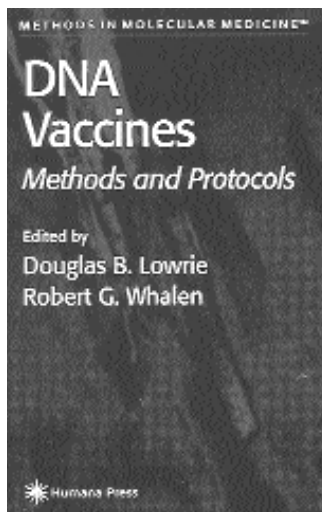
media, sterilization and axenic culture”, “causal agents of infectious diseases”, “oxygenic and anoxygenic phototrophic bacteria”, “metabolism and enzymes”, “symbiosis”, “ecology of microorganisms”, “mutation and genetic transfer”, and “regulation of metabolism”, are some of the topics covered. Of great interest is the chapter devoted to spontaneous generation, a topic most discussed throughout history. Jan Baptist van Helmont (1577–1644) seemed to have clarified it when he stated that mice could arise from wheat covered with a dirty shirt soaked in sweat. If that were true, the supply of mice to research laboratories would be very easy. Fortunately, right ideas turn out to prevail, even if their proponents and later upholders often must face popular wisdom rooted in superstition, taboo and even religious belief. The church—Christian—has been reluctant to accept new ideas which are in contradiction with previous paradigms, especially when there is an apparent contradiction with what can be inferred from a literal interpretation of the Bible. At the turning of the XXI century, Darwinism might be removed from textbooks or even replaced by the account of the Adam and Eve’s myth in some areas of the United States. More often than not, scientific controversy is a reflection of social, political or religious confrontation. Textbooks, however, tend to omit this aspect of controversy, and show it only as a result of contrary scientific opinions.

As the reader goes forward, the main paradigms of microbiology disclose before his or her eyes. New challenges appear now and then, some of which still keep microbiologists busy. Nevertheless, the author has not made an account of the discoveries made over the second half of the 20th Century, let alone an assessment of them. In fact, he thinks that such discoveries, and their impacts, have been described both accurately and extensively in modern textbooks. The aim of this book is not to inform about the latest microbiological advances, but to provide the reader with an all-embracing view of each historical period. The author has indeed succeeded in his attempt. Leaving aside unnecessary jargon, Schlegel has written a history of microbiology accessible even to lay people, who will discover the wonders of the exploration of the subvisible world.

The book includes ninety-three illustrations (mostly portraits of microbiologists). Several appendixes comprise: a chronological table of milestones in microbiology going from 1676 (Leeuwenhoek and his microscope) to 1962 (R. Y. Stanier and his concept of prokaryotes and eukaryotes); recommended literature; annotated references to each chapter; a fifty page section of biographies; credits to the illustrations; and name and subject indexes. By taking a glance at both the twelve page name index and the twenty-three page subject index the reader can realize what an impressive amount of knowledge and data are concealed in the pages of this small—in size—, but great—in contents and value—book.

Geschichte der Mikrobiologie is recommended to those interested in expanding their own horizons by having a wide perspective of the past. Nowadays the past is being more and more overlooked, in the thought that nothing new can be learnt from our forebear's achievements. Schlegel has shown us that this is not so. Microbiologists that can understand German, should read this book. Those who cannot, should have the right of having it translated into English to enjoy it.

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DNA Vaccines: Methods and Protocols

D. B. LOWRIE, R. G.
WHALEN (eds.)

1999. Humana Press,
Totowa, New Jersey (Series:
Methods in Molecular
Medicine, vol. 29)

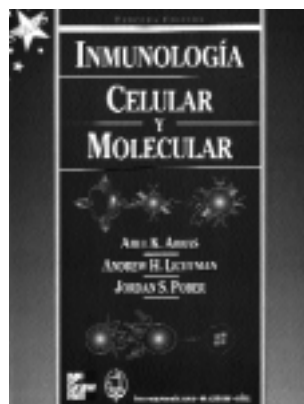
529 pp. 23.5 × 16 cm
Price: US\$ 99.50
ISBN: 0-89603-580-8

One of the most exciting advances in the technology of vaccines in recent years has been the development of DNA vaccines, through which the antigen is synthesized *in vivo* after direct introduction of its encoding sequences. As the editors state in the Preface, "the present state of affairs appears to date from observations made discretely in 1988 by Woll, Malone, Felgner, and colleagues, which were described in a 1989 patent and published in 1990." Since then, DNA vaccines have already been applied to a wide range of infectious diseases and tumors. Experiments on *Mycobacterium tuberculosis* DNA vaccines carried out in mice have proven that the vaccine not only prevents the disease in non-infected individuals, but can also stimulate the immune system in infected individuals (See Editorial, INTERNATIONAL MICROBIOLOGY 2[4], Dec. 1999, pp. 205–206). A major advantage of DNA vaccines is the endogenous synthesis of the encoded protein. Therefore, DNA vaccines mimic natural infection and provoke both strong humoral and cellular immune responses.

This volume in the Methods in Molecular Medicine series contains 41 chapters by 136 international contributors. Three chapters give an excellent overview on the immunology of DNA vaccines (Chapter 5, by T. Tüting et al.), immunostimulatory DNA sequences (Chapter 14, by J. H. Van

Huden & E. Raz) and controlled plasmid delivery and gene expression (Chapter 24, by R. J. Mumper et al.). These chapters are of great help to those non experts in immunology. The remaining thirty-eight chapters provide detailed information on key topics such as preparation of plasmid DNA, classical and genetic adjuvants, and vaccine design. Several contributors provide strategic ideas on antigen engineering, and describe novel applications of DNA vaccine methodology that have recently emerged. The last chapter ("Assuring the quality, safety and efficacy of DNA vaccines", by J. S. Robertson & E. Griffiths) provides an overview of the regulatory process by which an experimental vaccine can become a licensed product. It discusses in detail the quality and pre-clinical safety issues of plasmid DNA vaccines intended for humans, and includes a very useful appendix which informs about documents released by the World Health Organization (WHO), the US Food and Drugs Administration (FDA) and the European Commission, that researchers working on DNA vaccines should know. The format of the chapters is mostly practical; they comprise a concise, informative introduction, a list of materials (including leading suppliers) and a detailed description of methods, followed by an advisory notes section, in which useful tips gained through the experience of the authors are passed onto the reader, and a full list of recent references. As one might expect from a multiauthored book, there is some variation in the quality and length of contributions. Whereas some chapters have the protocols illustrated with helpful diagrams and figures, other chapters contain poor quality figures and some typographical errors. The target readership for the book is necessarily individuals and laboratories conducting DNA vaccines research.

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Inmunología celular y molecular

ABUL K. ABBAS, ANDREW H.
LICHTMAN, JORDAN S. POBER

1998. McGraw-Hill/Interameri-
cana, Madrid (3rd ed.)

574 pp. 21.5 × 27.5 cm
Price: 8600 PTA
ISBN 84-486-0221-8

The Spanish version of the third edition of the book *Cellular and Molecular Immunology* by Abul K. Abbas, Andrew H. Lichtman and Jordan S. Pober has been published by McGraw-Hill/Interamericana. As mentioned by the authors in the Preface,

a great deal of new information emerging after the last edition of the book, three years ago, made it necessary a new edition of this already "classical book" on Immunology. A major goal of the current edition has been the incorporation of new data and several colour pictures to illustrate the structure of immunological molecules in a growing field without a significant increase in the number of pages. This was possible by reducing the most classical topics, re-organizing the information and incorporating numerous new illustrations that, like in previous editions, make it easy reading this excellent text book for students of medicine and other related disciplines.

The book is divided into four main sections: Introduction to Immunology, Antigen Recognition and Lymphocyte Activation, Effector Mechanisms of the Immune Responses, and Immunity in Defense and Disease. In addition, an extremely useful appendix describes the main molecular and biological characteristics of CD antigens and, like in previous editions, each chapter comprises a short summary, a few key references and several boxed features which contain additional, relevant information.

The introductory part consists of a first chapter devoted to the general properties of immune responses, the differences between innate and adaptive immunity, and an explanation on the hypothesis of clonal selection. In the second chapter, a general description of the main cell types and tissues of the immune system is given.

The second section focuses on the cellular and molecular bases of the antigen recognition and lymphocyte activation. In the first chapter, the molecular structure and the functions of antibodies, including the mechanisms of antigen-antibody binding and a short description of the main techniques for antibody quantification, are reviewed. The structure and function of antibody genes, the molecular mechanisms for the generation of antibody diversity and the cellular basis for achieving the B-cell repertoire are studied in the next chapter. In the following ones, the antigen recognition by T lymphocytes is extensively examined beginning with a description, in Chapter 5, of the genetical and biochemical organization of the main histocompatibility complex (MHC), followed, in Chapter 6 by the analysis of antigen-MHC molecule interactions and the physiological relevance of antigen presentation. In the following chapters, authors describe the structure of T-cell receptor (TcR) for antigens, the immunological relevance of so-called co-stimulatory molecules and the mechanisms for T-cell activation. The expression of TcR genes and the T-cell development in the thymus are examined in Chapter 8. B-cell responses to antigens and T-B cell cooperation are reviewed in Chapter 9, whereas chapter 10 describes the regulatory mechanisms of the immune responses and the issue of immunological tolerance. This section ends with a description of the *in vivo* immune responses and emphasizes the principal characteristics of immune reactions occurring in different anatomical locations (spleen, lymph nodes, mucosae) and the cellular and molecular basis of lymphocyte recirculation.

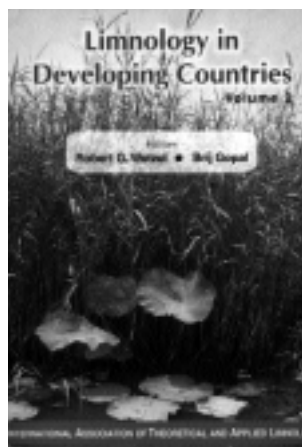
A general survey of effector mechanisms displayed by the immune system, is given in the third section. The cytokine production, the biology of effector cells (T lymphocytes, macrophages, NK cells) and the mechanisms of hypersensitivity mediated by CD4 T cells with the involvement of mast cells, basophils and eosinophils are studied. The complement system, one of the main effector mechanisms of humoral immunity, is also examined in this section.

In the last section, the authors analyse immune reactivity against pathogens and tumors, transplantation immunity, as well as cellular and molecular bases of autoimmunity, congenic and acquired immunodeficiencies.

In conclusion, the book is clearly written, and the contents which are presented and discussed in a logic way, provide a solid information both to beginners and advanced students.

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Limnology in Developing Countries. Volume 2

ROBERT G. WETZEL,
BRIJ GODAL (eds)

1999. International Association of Theoretical and Applied Limnology (SIL). International Scientific Publications, New Delhi, India

330 pp. 24.5 × 17.5 cm
ISBN 81-86047-19-0

This book is the second volume in a series aimed at reviewing "the status of conservation and management of inland water resources, and the state of limnological research and training" as well as "to identify gaps in knowledge and specific needs and priorities" in various developing countries. Aware of the need to promote limnology in developing countries, the International Association of Theoretical and Applied Limnology (SIL) decided to publish this series. Volume 1, released in 1995, included reviews of limnology in Ghana, Tunisia, Sri Lanka, Bangladesh, Papua New Guinea, Malaysia and Pakistan. Volume 2 comprises limnological reviews for five countries: Uruguay (pp. 1–31), Costa Rica (pp. 33–62), Ethiopia (pp. 63–118), Indonesia (pp. 119–234) and Morocco (pp. 235–330). Each of the reviews provides an overview of the physical environment, water resources and limnological research, besides information on the conservation and management of aquatic resources in the country.

The first review, "A Review of the State of Limnology in Uruguay" by D. Conde and R. Sommaruga, summarizes

freshwater's main problems in that country: eutrophication, heavy metal and pesticide pollution, wetland desiccation, introduction of exotic species, and potential acidification.

The second review, "Limnology in Costa Rica" by G. Umaña et al., outlines the great diversity of the numerous lakes in that country, probably more than five hundred. They range from lakes near sea level to lakes above 3000 m. There are glacial lakes, crater lakes on extinct volcanic cones (1000–3000 m), natural lakes in middle elevations (300–1000 m), dammed by landslides, lahars, volcanic mudflows or lava, and finally low elevation lakes. All these are diverse due to strong variations of temperature and rainfall. Like in Uruguay, limnological research focuses on achieving a better understanding of the ecology, stability, resilience and management of freshwaters.

The third review, "Limnology in Ethiopia" by C. Tudorancea et al., tell us about Ethiopian lakes that display a wide range of physical, chemical and biological features due to the variability of landscape, climate and complex geological characteristics. In fact, that African region was subject to dramatic tectonic movements, and the African Rift crosses the plateau in southern Ethiopia. It also describes the rapid population growth and the serious problems of water shortage and deterioration of water supplies due to pollution.

The fourth review, "Limnology in Indonesia. From the Legacy of the Past to the Prospects for the Future", by P. Lehmusluoto et al., summarizes the ecological health of large natural lakes. The major threats to natural lakes are population pressure, agriculture and human activities. It proposes a management of lakes and reservoirs based on multiple-objective and integrated planning, in which non-economic objectives receive much more weight. Water habitat management and lake quality control should be also an integrated part in sustaining economy and fisheries development. Attention should be given to protection and conservation of lakes and drainage areas.

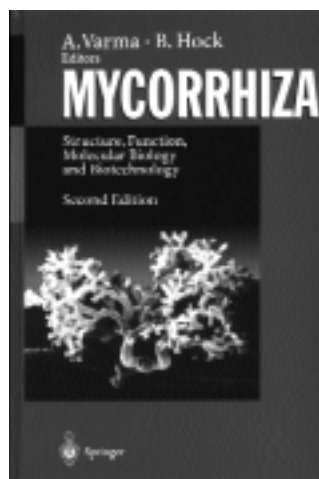
Finally, "Moroccan Limnology" by H. Chergui et al., informs about Morocco, a northeastern country of Africa that is simultaneously Mediterranean, Atlantic and Saharan. Many rivers, ponds and lakes are temporary. Information of the biota of temporary waterbodies is also given. Surface and underground water quality is also surveyed showing the main problems: lack of water in summer, urban pollution and occasional salinity. According to the authors, Moroccan fresh waters are currently very well known. Nevertheless, research on limnological ecophysiology, population biology and production are still poorly studied. This chapter includes three appendixes which list species from Moroccan reservoirs (planktonic species), shallow waterbodies (crustacean zooplankton), and northern and southern basins (benthic macroinvertebrates).

All reviews include an extensive list of references that help the readers to identify gaps in knowledge and specific needs and priorities in these developing countries. As the editors wrote in the preface "...we renew our hope that these reviews will

enhance appreciation of the diversity of aquatic environments and their importance, and will stimulate future research..."

Gemma Urrea

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**Mycorrhiza.
Structure,
Function,
Molecular Biology
and Biotechnology**

A. VARMA, B. HOCK (eds.)

1998. Springer-Verlag, Berlin
(2nd ed.)

704 pp. 24 × 16 cm
Price: DM 398
ISBN 3-540-63981-0
(hardcover)

Like the first edition of *Mycorrhiza*, this second edition summarizes and updates both the state of knowledge and theories on Genetics and Molecular biology (chapters 2 to 8), Structure (chapters 9 and 10), function (chapters 11 to 16), Biotechnology (chapters 17 to 20), Ecophysiology (chapters 21 to 25) and Systematics (chapters 26 to 28) of mycorrhiza. Great differences between groups of mycorrhiza, and the different significance of each of the lines of research, make the contents necessarily heterogeneous. Despite its heterogeneity, the book succeeds in agglutinating a series of reviews that are the best overview that we can find today on the main aspects of this field.

The first chapter, an excellent state of the art by D. J. Read, emphasizes the emerging trend in which symbiosis is placed in a broader context. The author highlights the fact that new research on mycorrhiza has to focus on matters related to fitness, such as seedling establishment and fertility, in contrast with classical research, which focused mainly on nutrition and development. In fact, mycorrhiza are especially structures of intrinsic biological interest, but their biological importance lies especially in the contribution they make to ecosystems by establishing durable relationships between plant and microbial communities. Conventional studies of single species or of individual plants and fungi in pots are unlikely to provide us much information to understand the functions of symbiosis. We shall be able to identify the impacts of symbiosis on the fitness of both partners and to understand the place of symbiosis in the context of their ecosystem function: not only mycorrhizal

fungi, but also other members of the microbiota are usually present in symbiotic multispecies communities associating each other.

After this introduction, new approaches to mycorrhizal research are described, under the shape of 27 independent works that have been developed like a discrete rainbow (with no connections among them). However, there is still room for research in that field. "Genetics and Molecular Biology" describes how molecular biology methods can lead to unequivocal identification of AM (arbuscular mycorrhiza) fungi, and to know their diversity, phylogeny, life cycle, and their regulation and function. Regarding to EM (ectomycorrhiza), there is presently considerable evidence that their formation and function alter both fungal and plant gene expression. This suggests that the EM development is ruled by morphogenetic patterns which respond to preestablished programs in both partners. As for the quantitative infraspecific genetic variation of some fungal properties, they may play a major role, either at the establishment or at a later stage once mycorrhiza has been established. The next contribution discuss how genetically altered EM fungi may substantially increase the yield and stress tolerance of associated plants and effectively enhance reforestation practices. Other contributions present the available techniques enabling us to understand compatibility to unravel the colonization process and to describe the communities of micorrhizal fungi formed by these processes: the use of plant mutants, intraspecific variants and non-hosts in the study of mycorrhizal associations, particularly VAM (vesicular-arbuscular mycorrhizas); a review of some representative results obtained by using antibodies, and the immunochemical techniques employed; and, finally, in contrast to previous techniques, the reliability, simplicity, low cost and major advantages of the somatic incompatibility procedure, despite the complexity of genetics.

"Structure" deals with the methods, applications and findings of electron microscopy of EM; reviews the latest literature on the presymbiotic structures of AM fungi; and describes some new data on their morphology and cell biology.

The "Function" part first discusses the role of proteins and gene expression for symbiotic compatibility, and their potential value to identify the fungal partner or the functional state of the symbiosis. It comprises also an update on carbon metabolism in mycorrhiza, the identification of some fungal determinants of importance to phosphorus transport and some aspects of the carbon balance of AM mycorrhiza. Nitrogen assimilating enzymes involved in biochemical pathways in EM, and the current status of the hydrolytic enzymes from AM in the process of root colonization, are also dealt with. A very interesting chapter follows, on how some host-free development of the fungus have been demonstrated, both in the plant rhizosphere—as shown by some fungal reactions prior to contact the plant—and in vitro, in response to different types of treatment, once it has been proven that none of the 130 species of AM fungi can grow successfully in axenic culture.

Biotechnology is then introduced with a discussion on the suitability of various culture systems on the EM symbiosis. After that, follows an extremely detailed text about the rationales and procedures for producing inocules of VAM fungi with aeroponic culture techniques. Then a chapter which presents the new developments in the potential use of biological tools of AM fungi, which should ensure adequate levels of food production with a satisfactory reduction of chemical fertilizer and pesticides, in the context of the technologies needed for sustainable agriculture. Finally, the problems and prospects of mycorrhizal and actinorrhizal biotechnology are developed.

Ecophysiology is structured in different chapters, which deal with the following topics: the current understanding of the taxonomic, structure and functional status of ericoid mycorrhizal systems; a review of how mycorrhizas change the supply of mineral nutrients that a given soil can supply thereby modifying soil fertility; mycorrhizosphere; and aggregates of soil particles, a major aspect of arid-stressed environments; the influence of soil acidity on AM symbiosis, and proposing some strategies which will contribute to a better understanding of the impacts of soil toxicity on the AM symbiosis; the impacts of soil toxicity on AM symbionts; the role of diversity in AM fungal communities, to highlight the fact that the wise application and maintenance of mycorrhizal fungi in the horticulture, agronomy, forestry, and land reclamation requires an essentially ecological perspective; and an attempt to define the ecological potential of *Azoarcus* spp. with rhizosphere fungi, suggesting the possibility of direct coupling of the metabolic capacities of both symbiotic partners.

At the end of the volume, "Systematics" begins with the developmental foundations for morphological diversity among EM fungi in Glomales and follows with the most extensive contribution of the whole book: an attempt towards a natural classification EM with a complete description of the anatomical characteristics of identified EM. The book ends with a communication about the first remarks on the symbiotic interaction between *Piriformospora indica* and terrestrial orchids.

The book might seem quite unbalanced; this work, however, is only a reflection of the present state of the art: on the one hand, research on that science has developed according to practical requirements with detriment to more theoretical fields; on the other hand, the great difference between mycorrhiza regarding the availability of axenic cultures, contributes to such different approaches.

For further editions it would be advisable to mention the date of each work or of their update. This information would be very useful for readers, as many chapters have been updated, and others have been replaced by new ones, the general topic being, presumably, under a constant process of review.

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