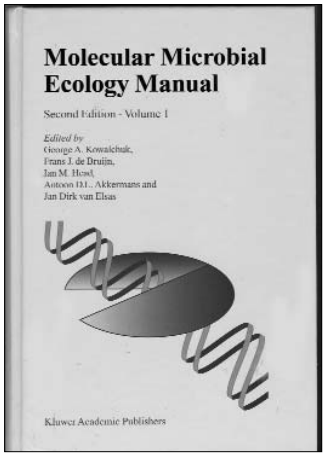
INTERNATIONAL MICROBIOLOGY (2007) 10:71-76
ISSN: 1139-6709 **www.im.microbios.org**



Molecular microbial ecology manual

GEORGE A. KOWALCHUK
FRANS J. DE BRUIJN
IAN M. HEAD
ANTOON D.L. AKKERMANS
JAN DIRK VAN ELSAS

2nd. edn., 2004, Kluwer Academic Publishers, Dordrecht, The Netherlands
Two volumes, 1780 pp, 17 × 24.5 cm
Price: € 395
ISBN: 978-1-4020-2176-3

Microbial ecology is one of the most recent and most remarkable subspecialties of the microbiological sciences. Its main objective is to study the role of microorganisms in nature and the relationships between microorganisms, other living beings, and the environment. Microbial ecology lies at the heart of the functioning of almost every ecosystem in the planet. From those engaging in symbiotic relationships or nitrogen fixation, to autotrophs, chemotrophs, and decomposers, microorganisms and their activities are integral components in the cycling of matter. They also constitute the bottom of trophic webs, regulate gas concentrations in the atmosphere, and contribute to the sustainable development of the biosphere. Consequently, they are an essential part of the planet's global functioning. Although the physical and chemical characteristics of "macroenvironments" are the result of microbial metabolism, the function and distribution of microbial populations themselves depend to a great extent on abiotic factors.

For more than a century, bacteria were studied as cell populations that acted independently. However, we now know that there are many mechanisms by which cells communicate and interact, and that bacteria produce enormous quantities of chemical compounds in response to different stimuli. This knowledge can be further developed and used in industrial, medical, agricultural, and bioremedial applications, among others. Conversely, progress made in our understanding of the natural world is usually preceded by technological innovations that allow for new and innovative observations, measurements, and experimental approaches. Microbial ecology is no exception. During the past two decades, the introduction of molecular methods, particularly when integrated with traditional studies in physiology and genetics, has revolutionized microbial ecology and allowed us to begin to study microorganisms that cannot be cultured in the laboratory. The insight gained from these studies has taught us much about the enormous diversity of the microbial world.

This second edition of the *Molecular microbial ecology manual* provides a detailed, user-friendly description of the methods that have facilitated the evolution of this field. Its content reflects the major advances and trends, and its sections have been updated or reassessed and modified accordingly to show the most relevant, widely used, and recently developed methods. The *Manual* is divided into two volumes and contains eight sections in total. The methods have been provided by experts in the field, including, in most cases, the laboratories that first developed and applied them, and the respective authors have contributed tips and insights gained through first-hand experience. Each chapter provides a brief introduction to the method as well as additional information, such as useful notes to guide the non-expert, general considerations, experimental approaches, tables, and diagrams and/or graphs related to the procedure or the expected results. This, plus the substantial bibliographies provided for every method, make the text an excellent all-round reference source of microbial ecology techniques, one of the best that is currently available.

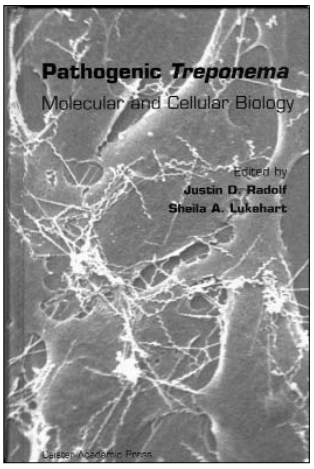
Volume 1 contains three sections dedicated to the isolation and detection of nucleic acids and the techniques used to identify and classify microbes in their natural habitats according to their DNA and RNA sequences. These techniques include the extraction of DNA from microbial mats, aquatic sources and sediments, soil and rhizosphere; its isolation from dairy products; and detection by fingerprinting, chemiluminescense, hybridizations, PCR, and colony hybridization

Volume 2 presents the other five sections. Section 4 describes the detection, identification, and classification of microbes by community-level physiological profiling, fluorescent staining for direct counts, scanning confocal laser microscopy, immunoflourescence, immunoenzymatic assays, in situ hybridizations, and phospholipid fatty-acid profiles. The combination of microscopy with the use of specific phylogenetic staining or fluorescent antibodies enables the specific detection and enumeration of bacteria in mixed populations. Most chapters in the last two sections have undergone significant changes since the *Manual's* first edition, due to the appearance of more efficient or more rapid methods.

Section 5 is dedicated to the detection of gene transfer in the environment. A wide range of bacteria express competence (the physiological ability to take up DNA) during normal growth, and plasmid DNA without homology to the host may be recircularized, allowing for transformation of different genera. This horizontal transfer endows microbes with an enormous genetic flexibility that allows them to respond and rapidly adapt to changing environmental conditions, in addition to having enormous phylogenetic implications. Section 6 deals with methods for tracking specific (target) microbes in the environment. The expression of genes that encode useful characteristics (key enzymes) in relation to environmental factors can be analyzed to obtain information about the ecology of functional bacterial groups and then applied to the recovery of genetically modified microorganisms from the environment. Section 7, on the quantitative assessment of data and the methods to couple microbial identity and function, aids researchers in determining the significance of molecular data pertaining to patterns of microbial diversity and thus to go beyond the simple detection of populations, to quantitative determination. Methods based solely on 16S rRNA analysis provide extensive information on the taxa present in an environment; but little insight into the functional role of each phylogenetic group. Therefore, other methods are needed to link specific functions with the group responsible for them. Molecular techniques such those explained in the *Manual*, including in situ use of microelectrodes, whole-cell biosensors, stable-isotope labeling, and proteomic analysis, equip us with the tools to understand the functional diversity of microbial communities, and ultimately of the ecosystem as a whole.

Molecular approaches promise fuller and more accurate descriptions of the real diversity, structure, and dynamics of complex microbial communities. While the *Molecular microbial ecology manual* describes most of the techniques a microbial ecologist might currently wish to use, it is more than just a manual; rather it seeks to provide the reader with the insight behind the theory and application of each protocol, and thus to answer the "why" of each method. Moreover, with its on-line format, emerging methodological developments can be periodically included, so that the *Manual* can continue to keep pace with advances in microbial ecology.

NICOLE SKINNER
INTERNATIONAL MICROBIOLOGY
nskinner@iec.cat



Pathogenic *Treponema.* Molecular and cellular biology

JUSTIN D. RADOLF, SHEILA A. LUKEHART (eds)

2006. Caister Academic Press, Norfolk, UK
466 pp, 16 × 24 cm
Price: US$ 280
ISBN 1-904455-10-7

Nearly 350 years ago, Anton van Leeuwenhoek, using microscopes he constructed himself, began to explore the human body. Several years after observing protists in water, he discovered bacteria on his teeth and recorded the diversity of these *beesjes* (beasties) or *cleijne Schepsels* (little creatures), as he wrote in Dutch (the Latin *animalculi*, in the translations of his time). One of his letters, published by the Royal Society, contains the first written description of what we know to be spirochetes. This new and "invisible" microbial world had no apparent function. Microorganisms existed, they had definite shapes and movement, but they were considered mere "curiosities". Of all the treponemes (a type of spirochete), the one that causes syphilis has, historically, been the greatest focus of attention, not only because of its disease manifestations but also due to the complex and still unsolved medical, social, and historical questions that surround it. The book *Pathogenic Treponema* highlights recent major advances in our understanding of *Treponema* biology, such as the organism's phylogenetic diversity, morphological features, metabolism, and motility.

The book is organized into 18 chapters, comprising four parts. Part I (Chapters 1-8), "The *Treponema* world", contains basic information about the genus *Treponema*. Part II (Chapters 9-13), "*Treponema pallidum*", discusses the history, pathogenesis, and immunology of syphilis. Treponemes exhibit enormous diversity and, appropriately, this book also includes many "non-syphilis" chapters, such as those in Part III (Chapters 14-16), "Oral treponemes", and Part IV (Chapters 17-18), "Other treponemes."

Chapter 1 reviews the phylogenetic relationships among members of the genus *Treponema*, including those which cannot be cultivated in vitro. It also illustrates the vast diversity of these spirochetes. Chapter 2 compares the sequenced genomes of several spirochetes: *Treponema pallidum*, *Treponema denticola*, two *Borrelia* species, and two *Leptospira interrogans* strains. Current information indicates

Molecular Microbial Ecology Manual. Article (PDF Available) Â· January 2008 with 1,106 Reads. DOI: 10.1007/978-1-4020-2177-0_101.Â In: Akker-. mans ADL, Van Elsas JD, De Bruijn FJ (eds) Molecular Microbial Ecology Manual, pp. 1.3.3/1â€“. 1.3.3.11. Kluwer Adademic Publishers, Dordrecht, The Netherlands. 24. Visuvanathan S, Moss MT, Stanford JL, Hermon-Taylor J, McFadden JJ (1989) Simple method. The Molecular Microbial Ecology Manual, Second Edition (MMEM-II) provides a detailed and user-friendly description of the methods that have made this revolution in microbial ecology possible. However, what is perhaps most exciting about MMEM-II is that it contains a large number of new chapters, highlighting the newest trends in microbial ecology research, which seek to provide more quantitative and statistically robust data, and means of coupling microbial identity and function. In addition, the majority of the proven methods described in MMEM's first version have undergone significant r