Reviews and Resources

BOOKS

Magnetoreception and Magnetosomes in Bacteria

Humans have always been fascinated by magnetic phenomena as eerie, often magical, experiences. The first practical application, the development of navigational technology using the compass, had a tremendous impact on European civilization and subsequently the whole world. It therefore came as a big surprise when, in 1975, Richard Blakemore discovered the magnetotactic bacteria, which are able to align themselves to the earth’s geomagnetic field. How dare these seemingly nimble organisms master a technology considered the greatest achievement of the Middle Ages!

As teachers, we are always in search of classroom topics capable of sparking enthusiasm and surprise. Magnetotactic bacteria certainly have what it takes to make it on Broadway. Relevant to the search for life on Mars, nanotechnology, and geomicrobiology, they can be all that and a bag of chips for both scientists and students with wide arrays of interests. Dirk Schüler did a great job as editor as he brought in an eclectic group of contributors, making it a pleasure to discover and now recommend this wonderful book. It contains a wealth of fascinating information that is presented in a way that immediately engages the reader.

The volume is organized into three major topical areas: microbial ecology, genetics and cellular biology of magnetotactic bacteria, and physical methods to explore biogenic magnetic particles. In addition, applications of what has been learned in nanotechnology and paleogeology are explored, as well as other, more exotic aspects such as the formation of magnetic minerals and the so-called multicellular magnetotactic bacteria. Altogether, it is difficult to choose a favorite chapter, as I found all of them very well written and quite captivating, though one of the few drawbacks was the occasional lack of consistency regarding references. I was elated to see the authors tackle the elephant in the room right up front in the first chapter: what could be the advantage of magnetotaxis? Is it, in analogy to human exploration, to provide another axis of orientation on which to speed down the highway searching for scarce sources of food? To make a long story short, I was sold and captivated by this book and would encourage everyone with an interest in these microbes to obtain Magnetoreception and Magnetosomes in Bacteria.

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Bacterial-Epithelial Cell Cross-Talk: Molecular Mechanisms in Pathogenesis

Bacterial pathogenesis is a complex process. It involves both a pathogen and a host cell that engage in a signaling cross-talk interaction. The book by McCormick provides a fascinating summary of the current knowledge of molecular interactions that take place between bacteria and epithelial cells of mucosal surfaces, including those of the respiratory, gastrointestinal, and urinary tracts. The book is divided into four parts and contains a total of 14 chapters that have been written by 26 leading researchers in the field.

Part I provides the reader with an overview about the epithelial cell (chapter 1) and the evolution of bacterial pathogens (chapter 2). More specifically, the reader is introduced to the many specialized functions of epithelial cells, as well as to the importance of membrane polarization and traffic, the cytoskeleton, intercellular junctions, and barrier regulations. The chapter on the evolution of bacterial pathogens includes the principles of mutation and selection, gene transfer and the role of plasmids, as well as of bacteriophages, transposable elements, and pathogenicity islands; the author of this chapter also describes the challenges bacteria face when colonizing a new niche, and discusses the role of pathoadaptation and genome reduction.

Part II is devoted to bacterial cell biology and pathogenesis. It is described how bacterial secretion systems (type I through type V) work (chapter 3), how host pattern recognition receptors (PRRs) recognize microbes to enable an appropriate host response, and what strategies some microbes have developed in order to evade PRRs (chapter 4). In the next chapter, the reader can learn about the role of flagella in pathogenic bacteria and in bacterial-host interactions, in particular during the initial stages of infection and during persistent colonization. Chapter six deals with fimbral and afimbrial adhesins; the author outlines the receptor targeting by bacterial adhesins and emphasizes the importance of a tight attachment of microorganisms to host cells in major infectious diseases. The final chapter in this section describes the many ways bacterial toxins can modify epithelial cell barriers (chapter 7).

Part III is about the various processes of host cell signaling by bacteria. As an example, the authors discuss the “trigger mechanism” that is employed by Salmonella and Shigella spp., and involves a type III secretion system to inject virulence factors directly into the cytosol of host cells resulting in a variety of responses, including host-mediated pathogen uptake (chapter 8). The following two chapters deal with two types of responses activated by bacterial-epithelial cell interactions; the first type is known as the nuclear factor
kappa B (NF-κB)-dependent inflammatory responses, and the second as the NF-κB-independent responses.

Part IV describes the exploitation of host niches by pathogenic bacteria. In the final four chapters of this book, the mechanisms and consequences of bacterial infections of the lung (chapter 11), the stomach (chapter 12), the intestine (chapter 13), and the urinary tract (chapter 14) are discussed. In these chapters, the authors essentially utilize the knowledge of the previous ten chapters and apply them to specific infections of the major mucosal surfaces. Where appropriate, they included information about the etiology, epidemiology, and immunology, as well as antimicrobial treatment.

I found this book to be exceptionally well structured and written, sufficiently illustrated and referenced, and of very high quality print. I agree with Dr. McCormick that “this book provides a valuable overview for graduate students and researchers.” I would thus highly recommend this book to all those individuals who have an interest in bacteriology, cell biology, and immunology, as well as microbial pathogenesis.

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