

and adipokines. A hodgepodge of nomenclature the author decided to subsume under the collective name of Body Messages. The first two chapters introduce readers to the concepts of biological information, molecular messengers, and cellular communication as well as different ways of conceptualizing biomedical research. Here we learn that the meaning of a molecular message is the change it introduces in a biological system, we assess strengths and limitations of beginning a project by starting with function or with structure, and we ponder about the wisdom of separating research into disciplines that end up fragmenting our body into artificial partitions. After these two initial chapters, the book plunges into its main topic, the process of discovery of body messages. Each chapter revolves around a different theme by addressing the history and biology of a separate group of proteins. Thus, in Chapter 3 we meet the interleukin-1 family while focusing on how the process of discovery evolved over time in parallel with technical advances. Chapter 4 reviews the discovery of tumor necrosis factor, interleukin-10, chemokines, and annexin A1 in the context of intestinal inflammation and the overall balance between pro- and anti-inflammatory mediators. In Chapter 5, the discussion turns to cytokine decoys, soluble receptors, and binding proteins, including an engaging story about the role Catholic nuns played in the discovery of the molecule that became Etanercept, an inhibitor of tumor necrosis factor that is one of the world's bestselling drugs. Interleukin-6 and the hepatic acute-phase response are the topic of Chapter 6, which revolves around the impossibility of neatly separating areas of research such as inflammation and metabolism. Finally, Chapter 7 discusses the discovery of the two adipokines leptin and adiponectin, comparing and contrasting, under a historical perspective, the process that led to identification of two proteins that revolutionized the way we understand the function of adipose tissue. To me, the reading of this last chapter was a very intense experience from both professional and emotional points of view. It gave me a chance to remember the people and facts that deeply marked my professional and personal life during the last 20 years.

Throughout the book, the history of discovery of each molecule is enriched by interviews with 20 scientists who played major roles in the process. The lives of these scientists are told—often in first person—in ways that are fascinating and in many places moving, allowing readers to get to know the protagonists of these critical discoveries in personable, humanizing ways.

With its lack of jargon, *Body Messages* provides compelling reading for both scientists and general audiences interested in knowing more about a chapter of the recent history of biomedical research that

has been among the most fruitful in terms of both theoretical advances and practical applications.

ORESTE GUALILLO, *Servizo Galego de Saude and Instituto de Investigación Sanitaria de Santiago, Santiago University Clinical Hospital, Santiago de Compostela, Spain*

**BIOCHEMICAL EVOLUTION: THE PURSUIT OF PERFECTION. Second Edition.**

*By Athel Cornish-Bowden. New York: Garland Science (Taylor & Francis Group). \$49.95 (paper). xviii + 274 p.; ill.; index. ISBN: 978-0-8153-4552-7. 2016.*

I wanted to hate this book. A title implying that evolution is the goal-oriented pursuit of *anything*—let alone perfection—is like a red rag to a bull. I need not have worried. Cornish-Bowden knows just as well as anyone that evolution “has no foresight; evolution prepares nothing for a hypothetical rainy day; evolution works only in the here and now” (p. 120), and by the end of Chapter 3 it becomes apparent that it is he who is pursuing examples of perfection in the evolution of biochemical systems. In doing so, Cornish-Bowden covers a broad swath of metabolic biochemistry, together with smatterings of genetics, cell biology, and cancer, plus two final chapters that address interesting but peripheral topics (what it means to be alive, and the rise of intelligent design). Readers with at least a little undergraduate training in biochemistry will have no trouble in following his arguments, although it will be a harder read for those who have never encountered the subject.

By using well-chosen examples and illustrative analogies, the author convinces us that some aspects of biochemistry—such as the structure of glycogen—appear impossible to improve upon, and therefore might be considered perfect. Of course, an evolutionary biologist would point out the untestable nature of this assertion, and remind him that something that is well-adapted now may be maladaptive in the future (in a wholly different environment). I particularly enjoyed Cornish-Bowden's discussion of the evolution of biosynthetic pathways and their regulatory mechanisms (Chapters 8 to 11). By incorporating key concepts from metabolic control analysis, he illustrates how stable steady states are inevitable in metabolism, and builds on this to provide a nice argument for allosteric enzyme regulation as a product of selection.

It is always easy to point out additional topics that could have been included. Many of the examples in the volume are from the work of Enrique Meléndez-Hevia. It was a delight to revisit this older work (mostly from the 1990s), but I believe Cornish-Bowden missed an opportunity to place more recent studies into the context of this earlier work. For example, I was surprised that Ron Milo's research on

pathway optimality did not make the cut, especially as he was acknowledged in the preface. The author also displayed a penchant for putting up, and then tearing down, straw men. In general, I found the large number of negative statements to be an unnecessary distraction, and the relevance of some sections (such as that on entropy-enthalpy compensation) to the overall thesis was lost because of them.

In summary, I congratulate Cornish-Bowden for shining a light on a fascinating subject. Is this the perfect volume? Not entirely. Do I hope that it inspires much more discourse among biochemists and evolutionary biologists—and therefore many more textbooks—in the future? Absolutely.

WAYNE M. PATRICK, *Biochemistry, University of Otago, Dunedin, New Zealand*

#### PLASMIDS: BIOLOGY AND IMPACT IN BIOTECHNOLOGY AND DISCOVERY.

*Edited by Marcelo E. Tolmashy and Juan C. Alonso. Washington (DC): ASM Press. \$150.00. xxi + 697 p.; ill.; index. ISBN: 978-1-55581-897-5. 2015.*

Not only are plasmids critical and fascinating endosymbiotic components of the prokaryotic genome and its evolution, but also the means by which they have organized their intracellular inheritance, intercellular mobility, and their development of genetic cargo remains one of the great stories of molecular biology. Although the elements of this story were well understood by the turn of the century and were thoroughly detailed in the 2004 book, *Plasmid Biology* (B. E. Funnell and G. J. Phillips. Washington (DC): ASM Press), the field has continued to grow apace and the present volume, a successor to the 2004 work, is, in essence, a comprehensive multiauthored update. As with any collation of individually crafted contributions, there is considerable variation in quality. One highlight is the chapter on plasmid partitioning, a phenomenon whose understanding has given rise to a riveting model of a fundamental and unique feature of the plasmid lifestyle. A towering tour de force is the chapter on plasmid diversity and adaptation, in which the now vastly documented world of *E. coli* plasmids is analyzed with state-of-the-art genomic tools and is a highly insightful treatise on plasmid diversity and evolution. This chapter, among a few others whose placement is odd, surely belongs in the section on Plasmid Ecology and Evolution rather than in Plasmid Maintenance, Transfer and Barriers. Other highlights are the chapters on the Ti and symbiotic plasmids, which thoughtfully document these wonderfully intimate plasmid-mediated interactions between bacteria and plants. Two of the chapters in a section on Plasmids as Genetic Tools merit special attention—Mining of Environmental Plasmids for Synthetic Biology Parts and Devices and

Plasmid Biopharmaceuticals, both of which address highly novel intellectual pathways into practical applications. The chapters on CRISPRs and on biofilm biology are *de rigueur* and informative, although neither is of major plasmid significance.

A problem with this book is that most biologists have little or no understanding of basic plasmid biology—even including those who developed the common plasmid vectors, which, needlessly, are seriously unstable despite their very high copy numbers—and one might have hoped for a framework on the principles of plasmid biology in the introductory chapter. Unfortunately, that chapter not only fails to provide this information, but is also disorganized and illogical and contains egregious errors of fact—the most glaring of which is that “[r]eplication of plasmids requires DNA synthesis proteins . . . [provided] by . . . [the] bacterial cell” (p. 4), shortly followed by a list of plasmid initiator proteins with no indication that these are plasmid-coded and are the determinants of replicon (never defined) individuality. Readers would be well advised to skip it. The distressing omission of plasmid biology is not confined to the introduction. For example, there is no overall description of the several well-defined plasmid biotypes; there is no specific description of plasmid incompatibility and its mechanisms, nor is it made clear that negative regulation is the guiding principle of plasmid replication control. Especially troublesome is a chapter on DNA topology—plasmid DNA exhibits phantasmagorical topological behavior that is not only a delightful aspect of plasmid biology but, also, at the interface of biology and physics, serves as a highly useful model for all other DNA. I have, however, yet to see a readily accessible presentation of this topic and, unfortunately, the present chapter is no exception. On the other hand, there is excessively detailed documentation of individual plasmid features and their diversity and there is considerable redundancy, including no less than four chapters on resistance. Although many of the plasmid biology principles are mentioned, often indirectly, the overall impression is that the volume is useful only for an audience that is conversant with these basic principles. For this audience, it can be well recommended.

RICHARD P. NOVICK, *Microbiology and Medicine, Skirball Institute of Biomolecular Medicine, New York University Langone Medical Center, New York, New York*