point though is that much remains to be discovered. Students looking for puzzles to solve for their dissertation will find Peretti and Aisenberg's book inspirational. In the volume's foreword, Thornhill noted that "this collection of chapters on CFC in arthropods would greatly impress Darwin and be among his favorite books" (p. vii). I agree wholeheartedly but would add that Darwin would have much company in this assessment.

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DEVELOPMENT

Ecological Developmental Biology: The Environmental Regulation of Development, Health, and Evolution. *Second Edition.*

By Scott F. Gilbert and David Epel. Sunderland (Massachusetts): Sinauer Associates. $69.95 (paper). xvi + 576 p.; ill.; index. ISBN: 978-1-60535-344-9. 2015.

Evolutionary developmental biology (evo-devo) was born decades ago in part through the realization that much in evolutionary biology makes a whole lot more sense when viewed through the lens of development. Ecological developmental biology (eco-devo or eco-evo-devo) is now emerging as its own field in part because evo-devo is encountering its own limitations as it is trying to understand how and why development evolves the way it does in light of the ecological contexts within which populations of developing organisms find themselves.

Specifically, in the most basic terms, eco-evo-devo's raison d'être lies in the mounting body of evidence, accumulating across the tree of life, that shows that organismal development proceeds in tight interdependence with the environment, and that these interdependencies play critical roles in shaping and directing both the products—and the evolution—of development. Or put simply, eco-evo-devo posits that to develop is to interact with the environment, and that to evolve is to change these interactions in a heritable manner. As such, this field is forced to integrate a combination of approaches, concepts, and ways of thinking from diverse areas of biology well beyond development and evolution, including physiology, cell biology, microbiology, and epigenetics, as well as community and behavioral ecology. The resulting creative tensions make it one of the fastest moving, intellectually most stimulating, and possibly most relevant fields of biology as millions of species find themselves developing on a rapidly changing planet.

This second edition, written by two of its pioneers, serves as a primer to the field and is intended for advanced undergraduate students, although it is equally appropriate for graduate students, faculty, and the broader public who want to learn more about the field. Written in an engaging, clear, accessible prose, and richly illustrated with hundreds of high-quality images and graphs, it is organized into three main parts: the first part is focused broadly on the incredible diversity of mechanisms by which normative organismal development is dependent upon environmental stimuli. Here, environment-responsive development emerges as the norm, the way all development generally proceeds, and introduces readers to several topic areas that are receiving growing attention from diverse fields, such as developmental plasticity, epigenetic regulation, and developmental symbiosis. Part 2 in turn explores how disruption of environment-responsive development enables the origin of disease in all organisms, very much including ourselves. This part again touches on a stimulating diversity of topics, from developmental defense mechanisms to endocrine disruptors, and the developmental origins of human adult diseases, aging, and cancer. Lastly, the third part investigates the consequences of environment-responsive development in facilitating, hindering, or biasing evolutionary diversification, exploring among others topics such as the environment-induced initiation of novel traits and what is possible in evolution when inheritance occurs not just through genes, but also through the stable modification and transmission of environmental states across generations.

In this second edition the authors significantly expand on many topics, and include diverse novel findings that have accumulated since the first edition was published six years ago, resulting in a much deeper, richer coverage, including a broader range of compelling case studies. A partial exception to this is the chapter, Developmental Models of Cancer and Aging, which in the first edition was subsumed under The Epigenetic Origin of Adult Diseases chapter. Now standing on its own, this chapter provides a thorough introduction to the molecular and developmental mechanisms of aging and their links to cancer, and together with the newly revised chapter The Developmental Origin of Adult Diseases offers highly informative and applied perspectives on the diverse roles played by environmental context in facilitating normative and pathological human development and physiology.

In all of this, the authors go beyond a merely authoritative textbook on the discipline. For example, Gilbert and Epel explore how public policies around the world impact scientific research, or how novel industrial practices such as fracking may

amplify endocrine disruption of human development. Furthermore, in a thought-provoking philosophical coda, followed by several appendixes, the authors expand on the historical and philosophical aspects of the study of ecological developmental biology, and engage in the current debate surrounding the mounting calls for an extended evolutionary synthesis, to which eco-evo-devo is very likely to have much to contribute.

This is a well-written and valuable volume, which deserves to be not just on bookshelves, but to be read by anyone interested in why and how development and evolution unfold the way they do.

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CELL AND MOLECULAR BIOLOGY

CELL MEMBRANES.

By Lukas K. Buehler. New York: Garland Science (Taylor & Francis Group). $120.00 (paper). xvi + 382 p.; ill.; index. ISBN: 978-0-8153-4196-3. 2016.

Chapter 2 begins with a quote from Benoît Mandelbrot: "*If you want to understand the complexity of biological systems, do not look at what they are, but what it took to make them*" (p. 13). *Cell Membranes* by Lukas Buehler does indeed provide a comprehensive, insightful perspective of how lipids and proteins, in conjunction, effect biological function. The author describes his two passions in the preface: teaching biology and studying ion channels. In terms of the former, the volume is an educational experience that will appeal to scientists at all stages of their careers. It can be used for undergraduate and graduate courses as well as a holistic frame of reference for experienced researchers from most biological fields. The text is abundantly complemented by illuminating figures that carefully match molecular biology with membrane and protein structure and often pairs an image from an experimental study with a conceptual depiction. An example is Figure 3.22, which combines a simple graphic, a freeze-fracture replica of a gap junction, and experimentally determined structures to illustrate oligomerization and clustering of membrane proteins. In addition, tables in each chapter synthesize and distill often complex information in a manner that facilitates understanding and comparisons without sacrificing rigor. For example, Tables 3.2 and 3.4 summarize detailed information on the types and functions of lipid anchors along with the sequence features and consequent subcellular localizations of the proteins to which they are attached.

Two standout chapters that nicely build on earlier concepts are Chapter 4, The Biological Diversity of Membrane Lipids, and Chapter 8, Integration: Membranes as Gatekeepers of Information. Chapter 4 transforms a typically dry topic—the chemistry of lipids—into a portrayal of how the chemical diversity of lipids underlies biological diversity. Near the end of this chapter, the author discusses how the occurrence of lipids across organisms reflects phylogenetic relatedness. In particular, Table 4.10 summarizes the relationship between membrane lipid composition and genetic lineage, while Table 4.11 characterizes lipid distribution by domain and kingdom. Chapter 8 delineates the modes of cell communication and the logic of signal transduction pathways by analyzing and clarifying electron micrographs of synapses, fluorescently labeled thin sections, three-dimensional reconstructions of cell junctions, and molecular structures of cell adhesion proteins.

Although Chapter 3 provides a useful classification of membrane proteins into transmembrane and surface (peripheral) proteins, the majority of systems examined throughout the book focus on the former. This bias may reflect Buehler's second love: ion channels. In addition to a more balanced incorporation of surface proteins, the volume would provide an even greater service to the community by including chapters on the role of membranes in diseases, particularly cancer (a topic largely overlooked by the biological community) and the ways in which lipidomics and membrane-associated proteomes may be incorporated into the most recent interpretation of systems biology that has arisen this century.

The textbook is a joy to read and is highly recommended. It provides a scholarly, solid, and novel foundation for the integration of: lipid chemistry and diversity; cellular membrane design and organization; structures of transmembrane and surface proteins; and the contribution of each in driving cellular function.

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