BEHAVIOURAL RESPONSES TO A CHANGING WORLD: CHALLENGES AND APPLICATIONS.

Edited by Bob B. M. Wong and Ulrika Candolin. Oxford and New York: Oxford University Press. $145.00 (hardcover); $50.00 (paper). xiv + 362 p.; ill.; index. ISBN: 9780192858979 (hc); 9780192858986 (pb). 2024.

How can an understanding of animal behavior aid conservation biologists trying to find solutions to the challenges created by human-altered environments? In this edited book, Bob Wong and Ulrika Candolin—who have dedicated their careers to studying the impact of human-induced rapid environmental change (HIREC) on behavior—address this long-standing question. Each chapter is a review of a particular stressor or application by an expert in the domain, and each confirms that behavior studies are essential for a comprehensive understanding of animal responses to increasing anthropogenic disturbance.

The first part of the book, Challenges (10 chapters), covers how animals change (or not) their behavior in response to various stressors, including climate change, noise, light and chemical pollution, ocean acidification, invasive species, harvesting and habitat degradation and fragmentation, and urbanization. These stressors can act alone or collectively. This part provides several important insights. First, studies on behavioral responses to anthropogenic disturbances are a very recent development; this volume provides a comprehensive update on progress made in this field over the last 20 years. Second, beyond the direct response to the disturbance (e.g., avoidance), many, if not all, behavioral traits are impacted, resulting in multiple and complex consequences at various levels of biological diversity. However, most studies in this area focus on individual responses to disturbances rather than the consequences of these responses at demographic, community, or ecosystem levels. Although several chapters do mention these consequences, they are still largely speculative. Third, the chapters provide substantial evidence that behavioral responses are plastic (e.g., learned) and occur within an individual's lifetime. Often, this plastic response is associated with a decline in fitness, showing that it does not counterbalance the effects of disturbance. Other mechanisms are possible, such as segregation between disturbed and undisturbed areas based on individual behavioral differences, but these are less frequently discussed. A few chapters describe cases of long-term evolutionary responses across generations, caused by behavior-dependent fitness differences. Overall, this is a sobering section, outlining the many challenges that organisms face.

Fortunately, the second part of the book, Applications (nine chapters), offers a glimmer of hope. Given the complexity and multitude of factors, behavioral domains, stages of life, and biological levels involved, the solutions cannot be simple, and this complexity may overwhelm or discourage some readers. However, several chapters present successful case studies and provide clear guidelines, roadmaps, and achievable objectives. I particularly appreciated Chapter 14, which proposes human interventions in human-modified environments to promote adaptive phenotypic plasticity and evolutionary response, and Chapter 15, which shows us that, beyond demographic and ecological impacts, HIREC also strongly affect the welfare of wild animals, a dimension that is often overlooked.

This volume is primarily intended for academic readers. It plays an important role in reporting the multiple impacts of HIREC on animal behavior and their consequences. Within academia, these findings could inspire a new generation of students to conduct further research, improving our understanding of the topic and finding novel ways to mitigate the impacts. However, the book could also play an important role by informing stakeholders and policymakers about the existence of novel solutions to these issues, which are often ignored.

DENIS RÉALE, *Département des Sciences Biologiques, Université du Québec À Montréal, Montréal, Québec, Canada*

CELL AND MOLECULAR BIOLOGY

THE RESTLESS CELL: CONTINUUM THEORIES OF LIVING MATTER.

By Christina Hueschen and Rob Phillips; illustrated by Nigel Orme. Princeton (New Jersey): Princeton University Press. $85.00. xii + 424 p.; ill.; index. ISBN: 978-0-691-23636-0 (hc); 978-0-691-23637-7 (eb). 2024.

This volume is written around the premise "that new concepts are every bit as important to the forward progress of science as are the facts that inspire them" (p. 363), a view we concur with. In other words, new conceptual frameworks move science forward as much as new observations and technologies. The central theme of the book is the continuum theory, a mathematical description in which, for example, a flock of birds is described by variables such as density and velocity that vary continuously over space. The theory deals with emergent properties rather than individual birds. Throughout the work, the authors show that this, perhaps counterintuitive, approach can be effectively applied to diverse biological phenomena at a variety of scales.

The principles of the continuum theory are elaborated on by reference to the physical theories of

molecular diffusion, heat transfer, elasticity, and fluid dynamics, establishing and rehearsing the continuum theory protocol which is a recipe for constructing a continuum theory for any system of interest. In this first part of the volume, the emphasis is on physics and mathematics but with some application to biology in examples as diverse as chemotaxis, heat transfer and phase separation in a nematode, formation of digits, urination in animals, and the application of viscoelasticity to length changes of cell-cell junctions in tissues.

Biology comes to the fore in the second part of the book together with the second theme of the volume, energy. An exemplary case study is that of cytoplasmic streaming in a giant cylindrical cell of the alga *Chara*. Cytoplasmic streaming is caused by organelles being transported by motor proteins along cytoskeletal tracks, with ATP hydrolysis by motor proteins as the energy input. The sophistication enters the model by the realization that the cytoskeletal filaments are organized in turn by the cytoplasmic streaming itself, resulting in a self-organizing system that is effectively modeled by the continuum theory approach. Other biological examples are gastrulation, gut folding, flocking, and cell orientation in bacterial colonies.

Throughout the book, the concepts and mathematics are explained in clear language and by reference to diagrams. Despite this, the rapid introduction of physical and mathematical concepts as well as a considerable amount of notation makes the volume hard to understand for most biologists, primarily due to the intrinsic difficulty of the subject matter. We recommend that readers consult other sources as well, which are abundantly supplied in the further reading sections present at the end of each chapter. Anyone with a more quantitative outlook and a background in physics would benefit most from the book. One missed opportunity was not to elaborate on the point solutions and finite element methods mentioned throughout the volume. A tutorial on how to program these models on a computer would have provided readers with a direct route to applying the continuum models to their own work. We definitely recommend *The Restless Cell* for the mathematically inclined biologist.

Paul E. Schavemaker, *Biodesign Center for Mechanisms of Evolution, Arizona State University, Tempe, Arizona* and Sergio A. Muñoz-Gómez, *Biological Sciences and Center for Plant Biology, Purdue University, West Lafayette, Indiana*

CLIMATE CHANGE

Living with Climate Change.

Edited by Trevor M. Letcher. Amsterdam (The Netherlands) and New York: Elsevier. $127.50 (paper). xiv + 601 p.; ill.; index. ISBN: 9780443185151. 2024.

It is a challenging time for folks engaged in climate policy, science, and action—the many actions that need to take place and can be led by people in our communities, especially as international governance is imperfect. There is no sector of government, education, business, or community for which climate change adaptation is not relevant. All things need to shift to get us to a carbon-neutral future and circular economy. We are and will continue to (as the title of this book declares) be *Living with Climate Change*.

I valued the approach and ambition of this volume to provide insight and expansive reference lists from experts across diverse sectors and regions of the world. There is attention to what we know and what we can do, both of which are key to effective action. There are also moments of brutal honesty when authors admit what science cannot know or prove, because we cannot do the experiment to remove all of the fossil fuel-derived CO_2 or test the effects of geoengineering solutions prior to adopting them. How will we move forward to live with climate change?

No book can answer this question nor do the authors of the contributed chapters claim this. In each, they aim to provide what they know in hopes that what they know will be helpful to others. The volume works well as a reference or guide for further learning for scientists exploring new fields, policymakers, and the many folks engaged in the work of climate adaptation. Although at times there may be a dive into the technical, one can gloss over these sections if they are not relevant to their needs and focus on key concepts and then invest time to explore referenced articles and websites. This is what I often ask students to do when I teach—find what is meaningful to them and dive deeper. *Living with Climate Change* would enable an educator to take this approach in their course and is most suitable for graduate-level classes.

Areas of climate change adaptation included in the book are architecture, agriculture and water resources, human health, societal, legal, and opportunities for alternative energy futures. With so many job opportunities available for people catalyzing our shift to photovoltaics, geothermal, hydropower, ocean renewables, nuclear, wind, and hydrogen, I expect that the book could be valuable for anyone