

tematically confronted with reliable evidence. Here Jasienska's review does a good job of uncovering deficiencies in our understanding of the costs of human reproduction, where evidence is contradictory.

In summary, this is a stimulating progress report on the current state of one of several useful perspectives on evolutionary medicine.

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THE RUNES OF EVOLUTION: HOW THE UNIVERSE BECAME SELF-AWARE.

By Simon Conway Morris. *West Conshohocken (Pennsylvania)*: Templeton Press. \$39.95. xiii + 493 p. + 16 pl.; ill.; general index and index of genera. ISBN: 978-1-599-47464-6. 2015.

Many biologists first learned about paleontologist Simon Conway Morris while reading Stephen Jay Gould's wildly popular *Wonderful Life: The Burgess Shale and the Nature of History* (1989. New York: W. W. Norton and Company). Gould portrayed Conway Morris as something of a hero for his visionary reinterpretation of the Burgess Shale fossil bed, and he made sweeping claims about the contingent nature of evolution based on this reinterpretation. Many scientists might have been flattered, but not Conway Morris. He famously rejected the characterization, insisting that Gould had completely misrepresented his research and its implications. Conway Morris has since published numerous books and articles explaining that the Burgess Shale and, indeed, all of nature do not support claims about the importance of contingency and instead call attention to the ubiquity and universality of convergence.

His latest tome on convergence is called *The Runes of Evolution*, and it might just be his most expansive effort yet. The book is nearly 500 double-columned pages, almost 200 of which are notes and indexes. He defines convergence as "the otherwise uncontroversial observation that from very different starting points in the Tree of Life very much the same solution has evolved multiple times" (p. 3), and he spends the first few chapters describing the idea's major tenets and implications. This includes a helpful summary of convergence research in the history of science. Conway Morris offers the octopus as paragon evidence of convergence, noting that the animal has independently evolved many different qualities that we also recognize in humans, including vision, gripping, renal systems and, most enticingly, cognitive abilities.

The remainder of the volume surveys the apparently endless examples of convergence. Each chapter examines a different phenomenon and the myriad organisms from across the Tree of Life that have independently evolved very similar features. Exam-

ples include, among other things, the convergent evolution of predatorial weapons, locomotion, gripping, flight, and sexual reproduction in a variety of different species. Other chapters examine the convergent evolution of sight, taste, smell, and sound in dramatically different contexts. The most provocative chapters focus on the emergence of cognitive qualities such as sentience, self-awareness, language, intelligence, and playfulness among widely separated branches of the Tree of Life. Conway Morris closes by asking whether recognition of death is present in other species, and what that would mean for the evolutionary process in general.

Readers will find that the author focuses almost exclusively on animals, although there is a chapter dedicated to mushrooms and plants each. What is more, when it comes time to answer the question posed by the book's subtitle, *How the Universe Became Self-Aware*, Conway Morris largely defers (p. 286). Quibbles aside, this is a very good book. The author is most effective when presenting his evidence as both glaringly obvious and unfairly maligned. Not everyone will like the volume's familiar tone, but the overall excellence of the writing is hard to deny. Many of the book's grandest ideas were already covered in his previous publications, but *The Runes of Evolution* is nevertheless Conway Morris' most comprehensive statement on convergence to date, and is thus well worth reading.

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ECO-EVOLUTIONARY DYNAMICS.

By Andrew P. Hendry. *Princeton (New Jersey)*: Princeton University Press. \$65.00. xii + 397 p.; ill.; index. ISBN: 978-0-691-14543-3. 2017.

Eco-evolutionary dynamics is a young field of whole-organism biology that investigates how the ecology of organisms (interactions between them and their environment) drives their evolution and, importantly, how that evolution feeds back to change their ecology. It has become something of a hot topic in the last decade. It is hard to say exactly why. Does the hyphenation create a certain allure, like a double-barreled surname? Is there a frisson excited by the idea that different processes and scales *interact*, that there are feedbacks? Or is it just that there is a yawning gap at the interface of ecology and evolution that is finally being filled? Of course ecology and evolution do interact, and there are feedbacks, but what is at stake is the temporal scale of them. Eco-evolutionary dynamics makes the explicit claim that important feedbacks occur on contemporary timescales. I confess to being skeptical of some of the claims, but more of that later. Overall this is an outstanding re-

search textbook, which should also be useful in teaching the highest level undergraduate courses.

The volume (12 chapters) begins with an introduction that uses the well-worn, but accessible example of Darwin's finches to lay out its conceptual approach. This separates the book into three themes: "Eco to evo," "Evo to eco," and "Underpinnings." Hendry himself has made many significant contributions to each of these areas through a wide-ranging portfolio of research and review, and is therefore well placed to summarize the field. As a result, the volume is a tour de force in terms of its grasp of the literature.

The themes themselves are further organized into chapters. Eco to evo is split into five: Selection, Adaptation, Adaptive Divergence, Gene Flow, and Ecological Speciation. Much of this is familiar evolutionary ecology, but it is well summarized and presented. Evo to eco is comprised of three chapters: Population Dynamics, Community Structure, and Ecosystem Function. The latter two seem to me the real essence of eco-evolutionary dynamics. It is still unusual, and powerful, to see evolutionary variation interpreted in terms of its ecological consequences. It would be a step forward in the interaction of the two fields if more of this material was incorporated into undergraduate ecology classes. However, there is a caveat: a real problem for eco-evolutionary dynamics is being able to attribute the involvement of evolution to causes and effects. For example, can effects on communities that are mediated through population dynamics (Chapter 7) be interpreted as evolutionary? Or are these really eco to eco, in the classic sense of trophic cascades? Again, the substitution of phenotypic for evolutionary variation in many of the empirical examples makes them less than convincing, because phenotypic variation (especially in body size) can arise from plasticity, which is at best an eco-evo interaction itself, if not a straightforwardly ecological effect. To his credit, Hendry repeatedly draws attention to these issues, but the solution is not easy. A truly convincing example would demonstrate an association between change in genotype frequency within a population, and subsequent ecological effects, preferably in an experimental context in a natural setting, but I recognize that that is asking a lot.

There are two chapters in the final theme, Underpinnings: Genetics and Genomics, and Plasticity, before a useful final chapter, What We Do and Don't Know. The Underpinnings chapters provide some useful background on the underlying control of the phenotypic variation that is the book's focus. I could not help feeling that Hendry missed an opportunity here. Of course, he did not really have a choice because the great majority of the work he reviews is rooted in phenotypic studies. But in the light of high-throughput genomic methods, the phe-

notypic focus is beginning to seem old-fashioned, especially given the increasingly apparent difficulty of connecting phenotypic selection to genetic evolution, and the overwhelming concentration of phenotypic studies on morphological and life-history (compare physiological) traits. Real insights at the interface of ecology and evolution will come from improving the mapping of genome to phenome to fitness, and the interaction of this with environment, but that is a can of worms, and probably another book.

Throughout the volume, each main chapter is structured as a general background, followed by a series of pertinent questions. I think this approach is very strong, because it forces readers to confront questions in the way that all good research should. However, it has the downside of making it difficult to get an appreciation of the whole story for a single system, perhaps detracting from their plausibility. It would have been good to see a couple of case studies (*Poecilia? Populus?*) worked through in a narrative style.

Although I would not have chosen the title Hendry did, because I for one do not define eco-evolutionary dynamics so broadly, this is nevertheless an excellent, and timely, synthesis of the growing body of work on interactions between ecology and evolution. It should be especially useful to anyone embarking on a research program in this area, for both the solid foundation and new ideas that it provides.

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BEHAVIOR

OUT OF EDEN: THE SURPRISING CONSEQUENCES OF POLYGAMY.

By David P. Barash. Oxford and New York: Oxford University Press. \$29.95. v + 230 p.; index. ISBN: 978-0-19-027550-1. 2016.

What makes us human? Although there are many answers to this important question, one thing is for sure: all of the best answers to this question are rooted in an evolutionary perspective (see G. Geher. 2014. *Evolutionary Psychology 101*. New York: Springer).

For Steven Pinker (1994. *The Language Instinct*. New York: W. Morrow and Company), we are *the linguistic ape*—and it is language, first and foremost, that set us apart from other primates. For Geoffrey Miller (2000. *The Mating Mind: How Sexual Choice Shaped the Evolution of Human Nature*. New York: Doubleday), we are *the creative ape*, with a unique