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Telling the "Great Stories of Earth"

Biogeography: Biological Diversity across Space and Time (Fifth Edition), by Mark V. Lomolino, Brett R. Riddle and Robert J. Whittaker, 2016

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In his short book on the importance of ignorance in science, neurobiologist Stuart Firestein (Firestein, 2012) described his realization that, by conscientiously lecturing through the accumulation of facts laid out in a massive textbook, he had probably given his students the impression that everything important in neuroscience was already known. As a young student, this was certainly my impression of biology—until the day my undergraduate entomology class was shown a video of Terry Erwin (Smithsonian) fogging forest canopies in Panama. It wasn't just the glorious rain of beautiful tropical insects that made this event so memorable; it was that these species were all unknown to science, and the revelation that the natural world offered so much that remained to be discovered. This served as a stark contrast to the textbook descriptions of the living world, which (as I remember them) were quite convincing in their message of *This is how things are*, not *These are the interesting questions still to be answered*. They had left me with the impression that we had life on Earth mostly figured out—the important processes, at least.

Biogeography: Biological Diversity across Space and Time, by Lomolino, Riddle and Whittaker, is organized in an entirely different vein. Lomolino et al. successfully represent the field of biogeography as a living, breathing, dynamic discipline, with its basis in humanity's natural tendency for discovery and observation. This emphasis on discovery is cultivated from the first chapter where they boldly state that "we have not answered and most likely will never answer" the driving questions of our discipline, to their presentation of the growth of biogeographic thought from ancient knowledge through modern theories, in which discovery continuously opens new avenues for ideas and investigation, to the conclusion in which they call for scientific humility as the path to new discovery in the "most integrative of disciplines."

Biogeography is primarily intended for undergraduate and graduate students, developing the background knowledge they need to interpret biogeographic patterns and participate in the discovery process. The book is divided into six units which split rather neatly into two parts. The first three units are thorough in their description of the philosophical, geographical, ecological and Earth history foundations of biogeography, including the terrestrial and marine realms. Critically, they make no assumptions about the ecological or evolutionary background of the undergraduates who might be interested in a biogeography course. The last three units describe the contemporary practice of biogeography, including historical, ecological and conservation biogeography. For new and veteran graduate students, these units are a fantastic introduction to the history, literature and theories of the field's major subdisciplines. Generously scattered throughout all chapters are vibrant full-color figures and well-placed boxes with illustrative examples, as well as reference tables which make this book an excellent desk-top reference for any student of ecology and evolution.

However, *Biogeography* really has something for everyone, from the new student to the established practitioner, and the in-depth overview of the background, major theories, and recent developments within historical, ecological and conservation biogeography will be insightful to researchers at all career stages. These last three units are replete with excerpts from the classical early works of the 19th and 20th Centuries that are articulate and rich in imagery, integrated seamlessly with important theoretical developments and contemporary directions. The litera-

ture cited is, for the most part, timely and up to date, drawing on a rich blend of classical and recent works. Further, a notable minority of citations include recent work by young scientists, many of whom are pre-tenure, reinforcing the authors' point about biogeography as a growing and innovative discipline. While the book closes by illuminating the biogeography of humanity, this is by no means the first mention of our impact on species distributions, evolution and extinction, and Lomolino et al. highlight numerous instances where fundamental biogeographic patterns may already have been altered by human activity.

Of course, no synthetic work of this breadth is going to cover every topic to everyone's satisfaction, and it is always easiest to critique the sections that align with one's own interests. With that caveat, I felt that the chapters on the evolutionary and geographic history of lineages were perhaps not quite as up-to-date as the rest. First, it would have been interesting to see some discussion of the growing body of macroevolutionary methods which use the phylogeny to investigate the complex relationship between geography and diversification (see Kennedy et al., 2017 for a recent example). These studies provide a distinctly different window onto the origin of diverse regional and continental biotas than the other methods featured in these chapters. Second, given the brevity of the section on statistical phylogeography, I was surprised to see how much emphasis was placed on Nested Clade Analysis, which has been heavily criticized (e.g., Beaumont et al., 2010) and largely superseded by coalescent methods, which received much less focus despite their significant contributions to statistical phylogeography over the last decade. Finally, while novel genomic methods are profoundly changing the way we do and think about phylogeography and systematics (e.g., Edwards et al., 2016), the genomics era is scarcely alluded to here and many of the references to Next Generation Sequencing are quite old, which makes these chapters feel a bit dated. However, even given these small disappointments, these chapters still provide an amazingly rich introduction into the background, practice and key contributions of phylogenetic biogeography. I look forward to using them in my teaching.

Rare is the book which is so successfully comprehensive of such a huge topic, and it is extraordinarily rare that such an account should also be suffused with the authors' enthusiasm, maintained throughout all 730 pages. Lomolino et al. certainly achieve that with the fifth edition of *Biogeography*, inviting the students to participate in the joy of discovery already known to most of you who are reading this review.

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