Spider Silk: Evolution and 400 Million Years of Spinning, Waiting, Snagging, and Mating

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book describes how food production systems can be designed and managed such that they produce food and also provide the multiple environmental services that we expect from natural landscapes (e.g., water production, soil protection, carbon sequestration, biodiversity conservation, etc.).

The two most distinctive (and valuable) concepts presented in the book are (1) migration rates are very likely more important than extinction rates as species move from one "natural" fragment of the landscape mosaic to another, and thus the agroecological conditions of the farmed parts of the mosaic are as important as the protected parts for conservation purposes; and (2) the full potential for linking agroecosystems and natural ecosystems can be realized only with fundamental changes in the nature of agriculture itself. Agroecology must be used to design and manage agriculture in diverse landscapes; this is currently best done by the networks of small farmers and farmer-based social movements that are investing in alternative farming practices, developing alternative market relationships, and striving for self-sufficiency and food sovereignty. Social justice becomes as important an aspect of landscape multifunctionality as biodiversity protection.

The book's coauthors, Ivette Perfecto, John Vandermeer, and Angus Wright, bring together complementary knowledge and experience in building their argument for linking "nature's matrix" with human needs and experience. Perfecto is a professor of natural resources at the University of Michigan and has extensive experience on biodiversity in agricultural landscapes, especially in the tropics, as well as issues related to sustainable development and political ecology. Vandermeer is a professor in ecology and evolutionary biology at the same university, and is one of the world's experts in the ecology of diversity and species interactions, and how such concepts can be used in designing complex cropping systems. Wright is emeritus professor of environmental studies at Cal State University, Sacramento, and a well-known expert in international environmental problems and social justice, especially in food systems. Their book is a unique combination of perspectives that offers the reader a revolutionary way of viewing landscape diversity. It begins with an overview of the concept of the "environmental matrix," and why it is important to view it as a multifunctional space that combines ecological and social values. A clearly presented ecological argument explains why biodiversity matters, yet also addresses that ecological theory and political realities are too often in conflict. The "agricultural matrix" is presented in an historical context as well as described as an element of new social movements focused on linking agroecology and biodiversity. Case studies drawn from the authors' vast field experiences are used to illustrate how landscapes are equally historical artifacts, hot spots of conservation, and centers for grassroots social movements. These include examples from the Brazilian Amazon; world coffee and cacao agroecosystems; and diverse, small-scale food production systems, with a strong emphasis on the tropics.

The integration of ecological, agricultural, and social-movement arguments for the establishment of a new paradigm for managing landscapes is perhaps the most valuable aspect of *Nature's Matrix*. Using what might be called an interdisciplinary approach, the book provides detailed ecological evidence for why diversity matters and how it works in diverse habitats. All chapters are thoroughly referenced and footnoted for those who want to go deeper. The authors present excellent examples that describe how diversity is equally important in all aspects of the landscape mosaic. Since most landscapes are inhabited and altered by humans to varying degrees—and will most likely continue to be and even increase in the future—this kind of agroecosystem design and management can become only more important. Examples of grassroots movements for food sovereignty and self-sufficiency in the book point out how best to ensure that the human footprint will be sustainable rather than destructive, both in ecological and social terms. Rather than looking at what has too often been seen as opposing goals (conservation vs. agriculture), the book offers a path for ensuring protection of vital environmental services while producing food and agricultural products in environmentally and socially just and sustainable ways.

Nature's Matrix is an important attempt to develop a new way of thinking about the roles of conservationists and conservation science in promoting and protecting the multifunctionality of threatened landscapes and the species that occupy them. The book is extremely well written and accessible, with theory and practice balanced throughout. The authors do not shy away from the hard questions about social justice, social change, and political realities in both the conservation and agricultural worlds. Instead, they call for a new paradigm that unites the two. Of course, this requires new thinking on the part of both worlds, but the framework is presented for those willing to explore the new paradigm.

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CAPTURED BY THEIR THREADS

Spider Silk: Evolution and 400 Million Years of Spinning, Waiting, Snagging, and Mating. Leslie Brunetta and Catherine L. Craig. Yale University Press, 2010. 248 pp., illus. $30.00 (ISBN 9780300149227 cloth).

Spider Silk: Evolution and 400 Million Years of Spinning, Waiting, Snagging, and Mating chronographs the evolution of spiders alongside a, if

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not the, key to their success: silk. This book is aimed at anyone with an interest in natural history, and provides a fundamental course on arachnology, evolution, and genetics. It therefore serves as an ideal introduction to spiders and a tempting peek at the field of silk research that I hope will leave the reader forever fascinated and enthused by these wonderful web weavers.

Leslie Brunetta is a freelance writer whose articles have appeared in the *New York Times*, *Technology Review,* and the *Princeton Alumni Weekly*, as well as on National Public Radio and elsewhere. Catherine L. Craig, a research associate of Harvard University and author of the monograph *Spiderwebs and Silk*, is an internationally recognized evolutionary biologist, arachnologist, and authority on silk.

A silk researcher myself, I can appreciate how, much like an orb-weaving spider's web, the authors attempt to combine several different threads, each with a specific function, into a structure carefully designed to ensnare the mind of the reader. They begin with one of the strongest, the scaffolding or dragline silk; a discussion about the genesis of the arachnids based on fossil records and a detailed history of evolutionary theory. From this scaffolding they then spin the underlying framework through their description of how minor changes in the structure of silk molecules have endowed the spiders with new silks to use and thus conquer their environment. This is then replaced by a captivating spiral of stories over the second half that delves into how silk plays an integral role in a spider's life from dispersal as young to capturing the next meal and mating.

This book is the result of a dialogue between a scientist (Craig) and nonscientist (Brunetta), and is essentially a more accessible version of Craig's excellent academic text *Spiderwebs and Silk*. The authors achieve the difficult task of conveying many high-level yet fundamental biological concepts while preventing the reader from becoming entangled in specialized language and theories. On occasion, however, this conversation becomes tangential, and the flow of the narrative is sometimes lost as the authors revisit concepts that would have been better introduced much earlier (specifically, the chapter on evolutionary-developmental biology). Yet these digressions are rarely laborious, and to the uninitiated, they serve as a good source of background knowledge that enhances the appreciation of the subject matter.

I particularly enjoyed the wide range of examples drawn from across the world of arachnids that build upon each other subtly, yet convincingly, into a cohesive and logical hypothesis for the evolution of web structures and how they represent evolutionary trade-offs between a range of competing ecological and genetic factors. This was all explained in a well-conceived manner and endows the reader with unique insights into the mindset and approaches taken by an evolutionary biologist.

Those who read *Spider Silk* in the hope that the mysteries of silk's superior mechanical properties will be revealed may be surprised to learn that we don't really know (yet). I was relieved by this truly refreshing admission, as I work in a field where most would have you believe that this mystery is solved with every new paper. I do feel, however, that the authors lacked conviction with respect to our current understanding of structure–function relationships in silk. Their explanation tends to focus too much on the protein sequence and, in my opinion, not enough on the other, equally important aspects of silk production: the coevolution of the glands (morphology) and how silk is spun (behavior). For example, the same silk protein pulled through the same silk duct at different speeds produces fibers with very different mechanical properties, something eminently more phenotypically plastic than chancing upon a new beneficial mutation. However, I think this merely highlights why we are so fascinated by this material; its elusive qualities are just out of our reach, and only through continued research and inspiring the next generation of scientists from all disciplines to tackle this important and interesting issue will we be able to "unravel" the web.

In summary, Craig and Brunetta successfully walk the thin line between education and entertainment, providing a solid foundation from which the reader can balloon into the world of the arachnids.

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WHY SCIENTIFIC LIVES?

Remarkable Biologists: From Ray to Hamilton. Ioan James. Cambridge University Press, 2009. 196 pp., illus. $46.99 (ISBN 9780521699181 paper).

Ioan James is emeritus professor of mathematics at Oxford University, and in recent years he has become interested in scientific lives. As with his earlier *Remarkable Mathematicians* and *Remarkable Physicists*, here too, in *Remarkable Biologists*, he fancies himself neither a professional historian nor philosopher of science but rather more like an ice-cream vendor, providing stylized tastes on small

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