economic "equations": governed only by Adam Smith's "invisible hand," *laissez-faire* will dependably produce wealth, philanthropic benefits, and the basic science that society needs as well as governments prosperous and powerful. But it's possible to tell the story differently. Another version would explain the West's dynamic capitalism as, at least in part, the result of the European discovery that guns and trade, business and politics, are a potent mix. In a world in which economies have expanded in the wake of Portuguese gunboats in the Age of Discovery and that has seen the establishment of global military hegemony after the Second World War, it might be questioned whether there is any such thing as the classically free market, or whether instead there are only degrees of managed economies and various arrangements between government and business. If this is the case, then Kealey's demonized account will do little to help us understand the ways in which the modern, ferociously war-minded world has blurred the boundaries between public and private and thus compromised the dynamics of scientific change.

Economic Laws is a great read. It's sure to provoke discomfort, if not anger, especially among those who find themselves skewered by Kealey's wit and arguments. But so what? One must be clear about the author's targets. Few, least of all the author, would deny that science is a powerful cultural good. But science policies that presuppose the dominance of public versus private initiative on the grounds of historical inevitability and the alleged disinterestedness of the public scientist are another matter. In fact, such policies constitute for the author yet another self-serving myth that masks the vested interests of a powerful elite grown strong in the wake of two world wars. In a world in which science has replaced religion as the most powerful of orthodoxies, a "Protestant Reformation" might be a healthy thing. And Kealey would surely enjoy being its Martin Luther.

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Speedbumps for Adaptationism

Adaptation. MICHAEL R. ROSE and GEORGE V. LAUDER, Eds. Academic Press, San Diego, 1996. xiv, 511 pp., illus. $69.95 or £52, ISBN 0-12-596420-x; paper, $34.95 or £24.95, ISBN 0-12-596421-8.

While the elucidation of adaptation in evolution has long been a main avenue of biological research, several ruts and potholes have become evident in the past 30 years. Chief among these is "The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme" (*Proc. Roy. Soc. Lond. B* **205**, 581–98 [1979]), in which Stephen Gould and Richard Lewontin roundly castigated uncritical practices in adaptational studies, particularly the telling of "just so stories." "The spandrels" initiated an era of self-doubt and recrimination that had a chilling effect on adaptational biology. At the same time, however, it greatly enhanced receptivity to several positive developments that have smoothed the adaptationist road: new comparative methods rooted in phylogenetic systematics; an analytical framework that merges quantitative genetics, function, and natural history; and increasingly sophisticated study of ongoing adaptation in the laboratory, in nature, and in manipulated organisms and populations. Indeed, many of the criticisms made in "The spandrels" (directed, for example, at ignorance of history and disregard of constraint) have been coopted to generalize and improve the adaptationist program. The continuing fusion of molecular and evolutionary biology, moreover, should accelerate these developments.

With these welcome repairs, one looks for a corresponding road guide. The view from *Adaptation*, edited by Michael Rose and George Lauder, is bleak, however. The book is the first comprehensive examination of how adaptational biology is confronting the issues that "The spandrels" raised. It includes chapters on the major components of the field: argument from design, optimality models, quantitative and molecular genetic approaches, phenotypic manipulation, description of selection in the laboratory and field, phylogenetic systematics, and paleontology. Perhaps in continuing reaction to "The spandrels," most of the authors painstakingly emphasize the pitfalls of their approaches, the limitations of their assumptions, and the lacunae in our knowledge, and scrupulously avoid any sustained optimism. Michael Novacek concludes, for example, that paleontology provides no unique insights to the study of adaptation, and Rose's summary of the seminal advances yielded by studies of laboratory evolution (adaptation is a usual outcome of laboratory evolution, trade-offs sometimes occur, and different selection regimes yield different evolutionary outcomes) is damning with faint praise. Although Rose, Novacek, and the other contributors have provided affirmative and optimistic accounts of their approaches elsewhere, their effect here is to conclude that adaptation is just as problematic as it ever was, if not more so. They do this well!

Rose and Lauder encouraged their authors to present conflicting viewpoints. Not surprisingly for a field as heavily laden with jargon as evolutionary biology, the conflicts often concern terms and definitions. The authors seem to devote so much energy to defining what is or is not an adaptation that, to paraphrase contributor Geerat Vermeij, they overlook interesting biological phenomena for purely semantic reasons.

Not all in the book is pessimism, semantics, and faint praise. David Reznick and Joseph Travis, for example, provide an exciting account of studies in natural populations. The work they summarize furnishes abundant evidence that adaptation is ongoing in nature and amenable to analysis.

The book concludes with chapters on clade-level adaptation, subdivided populations, genomic parasites, and adaptive systems. Though these chapters are positive and interesting in their own right, collectively they make little contact with the treatments of organismal adaptation in the first part of the book. For that matter, *Adaptation* seldom advocates a multidisciplinary or pluralistic approach. Clearly, each approach represented in the book can contribute valuable insights, but none in itself suffices for understanding adaptation. The situation calls for a cogent articulation of how diverse approaches can be deployed in complementary fashion, rather than editorial isolationism.

Adaptation is a valuable and well-written cautionary work for those who would execute the adaptationist program. It culminates the current stage of post-"spandrels" adaptationism and, in assessing the state of the art, is likely to have a significant impact on the next generation of adaptational studies. This impact, however, may be achieved primarily by discouraging adaptational biologists rather than by presenting a vision of the next stage. Whether *Adaptation* is a milestone or a millstone, it shows clearly how "The spandrels," by raising the standard of proof, ultimately enhanced and energized the study of biological adaptation.

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