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BOOK REVIEW

Peter Godfrey-Smith, Philosophy of biology

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Today it is easier than ever before for students of biology or philosophy to find good introductions into philosophy of biology. Over a dozen anthologies, handbooks, companions, and textbooks have been published in recent years, covering all major themes in this flourishing field of studies. Peter Godfrey-Smith's *Philosophy of Biology* is a valuable addition to the introductions already out there, and one that stands out in many ways.

The book begins with a brief introductory sketch of the history of biology. The philosophy begins in earnest in chapter 2, on "Laws, mechanisms, and models." After rehearsing some well-known arguments about the inapplicability of strict laws to biology, Godfrey-Smith explores the possibility of loosening up our conception of laws so that it applies to reasonably resilient and stable systems. In discussing this looser conception of laws, he takes cues from recent work on model-based science by himself and others, in which modeling is taken to be a "strategy" for representing the world with help of idealized and/or abstracted "surrogates" (p. 20). Godfrey-Smith connects this work on model-based strategies to the recent literature on mechanisms—representations of biological systems as composed of organized parts and activities. He points out that the mechanistic strategy applies well to the highly integrated systems we find in molecular biology, but sits less easily with the less organized, more "aggregative" systems studied by ecology and evolutionary biology (p. 18). The latter are better modeled by taking a statistical approach. To even refer to these as "systems" in which "mechanisms" operate is to stretch the

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terminology. "Population" is a more appropriate term for a phenomenon composed of parts that interact in looser and less regular ways (p. 17). Godfrey-Smith emphasizes that there is no hard cut-off point that separates mechanistic systems from populations. Instead, the biological domain is one where we find a large spectrum of intermediate cases.

The modeling approach and the mechanism-population spectrum are recurrent themes; they structure many discussions throughout the book. For example, in chapter 3, "Evolution and natural selection," we find a defense of the view that definitions of natural selection are in fact descriptions of (verbal or mathematical) models that idealize and/or abstract from actual cases in different ways. No single set of conditions can strictly *define* what natural selection is, different "summaries" of natural selection highlight different aspects of the same process. At the end of chapter 3—and even more so in chapter 5, "Individuals,"—the mechanism-population spectrum forms the backdrop for vivid discussions of degrees of "Darwinianness" of individuals and populations. In the context of individuality, this spectrum shapes the treatment of reproduction, which is responsible for cleaving entities into distinct individuals. Godfrey-Smith argues that biological individuals with a clearly separated germ-line, a distinct lifecycle-bottleneck, and a high degree of overall integration make for highly Darwinian individuals (p. 71ff.). They are clearly separated "mechanistic" systems that can form populations that can evolve through natural selection. This individuals-in-populations view becomes more blurred where we find less of a separated germ-line, a wider bottleneck, and looser integration. The lower an entity "scores" on these reproductive parameters, the more group-like it will appear, and the less distinct and evolvable the higher-level population will be.

To readers of Godfrey-Smith's previous book, *Darwinian Populations and Natural Selection* (Oxford University Press, 2009), this presentation of natural selection and individuality will sound familiar. The present book is indeed permeated with influences from that outstanding earlier work, which won the 2010 Lakatos award. Many parts of the framework presented in *Darwinian Populations* are simplified, adapted to the newcomer, and compared to other approaches in the literature. But Godfrey-Smith also develops his earlier framework in ways that will interest the initiated. The treatment of individuality, for example, extends into a further discussion of the relation between biological individuals and organisms. In other chapters, elements of the framework are applied to new domains in enlightening ways. For example, in the final chapter on information, Godfrey-Smith borrows the theme of "marginal" and "paradigm" cases to distinguish gradients of communication and information-transfer. All these discussions take seriously the idea that evolution creates (and recreates) grey areas and partial phenomena, which a sound philosophy of biology should be able to account for.

In some other chapters the influence of *Darwinian Populations* is felt less distinctly. Chapter 4, "Adaptation, construction, function", chapter 7 "Species and the tree of life", and chapter 8 "Evolution and social behavior" are nonetheless lucid discussions that put an original spin on complex topics. They go far beyond merely summarizing views "out there" in the literature. At the end of all chapters,

Godfrey-Smith provides ample pointers to the literature for further discussion—both the classics and the bleeding edge.

Coming in at just over 150 pages of main text, this is the shortest self-contained introduction to philosophy of biology I know of. It is therefore hardly surprising that some topics are covered only briefly, or make no appearance at all. Those interested in development will be struck by the fact that a key term like "homology" is never even mentioned. Still, this will undoubtedly be the go-to textbook for philosophy of biology classes for many years to come. It is philosophy of biology at its best, clearest, and tastiest. It will whet many a student's appetite for more.

Godfrey-Smith dedicates his book to the late David Hull, who had a formative influence on contemporary philosophy of biology. Hull's own textbook on philosophy of biology was published exactly 40 years ago (*Philosophy of Biological Science*. Englewood Cliff, NJ: Prentice Hall 1974), and educated a generation of budding philosophers of biology. Comparing the two textbooks shows how much the field has matured, and how much it has progressed beyond physics-inspired themes. Back in 1974, Hull already complained that "too often, in the past, issues in philosophy of science have been treated either in total abstraction from science or else solely in the context of physical theories" (p. 6). Hull's own treatment was nonetheless still colored by the topics of his day, such as theory reduction and the covering-law model. Godfrey-Smith instead puts the complexity of biological processes first, and then asks how they impact our science and philosophy. His angle is reflected in the terminology of clear phenomena "shading off" into partial cases, and of phenomena that disappear or come into view as our scientific eye "zooms out" to larger scales or broader time horizons. Philosophy of biology biologicized. Hull would have loved it.