

Marie I. Kaiser. *Reductive Explanation in the Biological Sciences*. History, Philosophy and Theory of the Life Sciences. Springer 2015. 277 pp. \$129.00. USD (Hardcover ISBN 9783319253084).

This book derives from Kaiser's dissertation work, entitled 'An Ontic Account of Explanatory Reduction in Biology', submitted to the University of Cologne in July, 2012. However, this is not merely a slightly worked-over dissertation; it has been substantially rethought, developed, and complemented by work that she has done in consultation with the German research group 'Causation, Laws, Dispositions, and Explanation at the Intersection of Science and Metaphysics'. Her aim in this book is to understand what reduction is in biological *practice*, rather than in theory.

The first chapter serves as an Introduction to the whole work. She describes the goal of the book as being the provision of an understanding of the important character of explanatory reduction, or more precisely, reductive explanations. Her central question is: what makes an explanation in the biological sciences reductive and distinguishes it from non-reductive explanations? The general topic of the book emerged as a distinct topic from at least the early 1960s, so the topic is not new. However, the particular question that she addresses, the way she approaches the question, and the answer that she gives are novel. Indeed, most discussions about reduction in philosophy of biology have focused on either the question of whether reductionism or anti-reductionism is correct, or they are centered on a particular understanding of reduction, such as Ernest Nagel's formal model of theory reduction. Her analysis in this book differs from these classical disputes in both respects: she does not aim to defend either reductionism or anti-reductionism, or to discuss it within the narrow confines of the Nagelian model of theory reduction. Rather, she focuses on a question that she thinks is prior to discussions about explanatory reductionism, that is, what does it mean to explain a biological phenomenon in a reductive manner? Her account presents an alternative way of thinking about epistemic reduction in biology, which does not remain within Nagel's framework that reconstructs reduction as a relation of logical derivations between theories.

In her second chapter, she discusses some meta-philosophical preliminaries, such as describing biological practice, descriptive versus normative projects in philosophy of science, why pure description is not enough, and the relevance of philosophy to science. This chapter serves as an explication of the aim of her analysis, the philosophical methodology by which she develops her account, and the criteria of adequacy that she accepts. She therein characterizes her own methodology as bottom-up, as being normative in a way, and as descriptive in character. Chapter 3 draws out some lessons from the previous debate, particularly that we must understand reductionism before disputing about reductionism; it is epistemology that matters most; we must distinguish between different types of reduction; and that it is time to move beyond Nagelian-style reductionism. She herein presents what she conceives are the most important lessons of this debate, and thereby introduces the reader to important concepts and distinctions. She adduces reasons why she develops an account of explanatory reduction rather than ontological reduction, methodological reduction, or theory reduction.

In chapter 4, Kaiser delineates two perspectives on explanatory reduction: reduction as a relation between two explanations, and individual reductive explanations. She contends that the former perspective has several shortcomings, and that the latter is the more promising path. Chapter 5 looks closer at biological explanations, considering the Covering-Law model and the Causal-Mechanical model. In this chapter, she answers two questions: does the question of what determines the reductive character of a biological explanation boil down to the question of a biological explanation? And, do debates about the truth of explanatory reductionism depend on specific discussions about explanation? Herein, she also discusses the pragmatic dimensions of explanations. Chapter 6 is the culmination of her argument in the book thus far, and is an ontic account of explanatory reduction. She starts by briefly specifying the two concepts that occupy center stage in her conception: the concept of a biological part (or of a whole-part relation) and the concept of levels of organization. Therein, she gives demonstration of her notion of biological parthood and the methodology of her account. She notes that her account starts with molecular biology, and that there is a unidirectional flow of explanation. The seventh chapter serves as a conclusion to the text, which is followed by a nice list of references. The main result of her analysis of biological practice is that reductive explanations in biology possess three features: they display a lower-level character, they focus on factors that are internal to the biological object of interest, and they describe the biological parts of this object only as parts in isolation.

Understanding what reductive explanations are enables one to assess the conditions under which reductive explanations are adequate, thus enhancing debates about explanatory reductionism. The account of reductive explanation presented in this book has three characteristics: first, it emerges from a critical reconstruction of the explanatory practice of biology itself; second, the account is monistic since it specifies one set of criteria that apply to explanations in biology in general; third, the account is ontic in that it traces the reductivity of an explanation back to certain relations that exist between objects in the world, such as part-whole relations and level relations, rather than to the logical relations between sentences. I could foresee this title being productively used in graduate-level biological courses as a supplementary text.

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