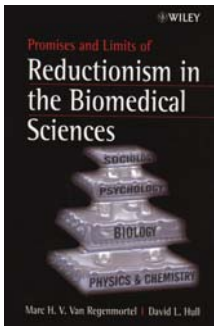

Reductionism in the Biomedical Sciences

Edited by Marc H.V. Van Regenmortel and David L. Hull, John Wiley and Sons, Chichester, UK, 2002; vii + 377 pages, US$120.00, ISBN 0-471-49850-5

To appreciate the impact of reductionism on biology, one should begin by revisiting science in the mid-19th century. Dramatically diverging from the previous concept of vitalism, which attributed life to a special life force, the philosophical foundation of science shifted toward positivism, which attempted to understand the world in non-personal, emotionless terms. Positivism required neutral and dispassionate objectivity, and mandated novel scientific principles based on truth, rules and criteria for evaluation that were independent of the observer and shared by the scientific community. Positivism surmised that all of nature consisted of the same elements and adhered to the same laws. Consequently, it was argued that, if living and inanimate matter formed a continuum, it should be possible to reduce the organic to the inorganic, biology to physics.

Jan Smuts in the 1920s might have been the first to recognize that reduction, by simple mechanistic causation alone, was insufficient to explain complex, living systems and called for a holistic approach with an ethical imperative (p. 267). At the same time, Ludwig von Bertalanffy developed the foundations of today's systems biology [see 1]. These non-reductionist ideas, however, were all but ignored, and most 20th century biologists continued to pursue the thesis that all biological phenomena were reducible to physics and chemistry.

Antireductionists do not dispute such physical foundation, but they reject reductionism's explanatory claim and therewith its methodological morale (p. 125). The dispute between reductionists and antireductionists can thus be traced back to the question of what constitutes an explanation. *Reductionism in the Biomedical Sciences* discusses this issue in great detail, and the biologically-oriented reader will find a lot of philosophical discussion, although not much of a pragmatic answer beyond the insight that reductionism will probably not answer all questions in biology, psychology, medicine and the social sciences. At issue is the fact that biologists call the discovery of a biological cause for a phenomenon an 'explanation', a term that is more stringently defined in philosophy. To appreciate this discrepancy in an efficient manner, the reader should go straight to Chapters 7 and 13 by Rosenberg and Tauber. As a contrast to these philosophical treatises, the reader could continue with Schaffner's summary of the mindset and future of modern molecular biology (Chapter 16) and finish with the last roundtable discussion, which finally pinpoints the crux of the discrepancy: the standard philosophical definition of reductionism is 'the complete description of the entire system in terms of entities at a lower level' (p. 354), while biologists are typically content with 'partial' reductions.

Written primarily by philosophers, *Reductionism…* tries to be provocative in the 'erotetic' tradition of Socrates, who led his disciples toward truth by asking questions that sounded harmless at first, but quickly uncovered a lack of true knowledge even about basic aspects of life. The editors of the book apparently attempt to emulate this strategy in the introduction with statements that are intended to be thought provoking, but in fact are rather absurdly antagonistic, presumably for effect. For instance, it is said (p. 2) that reductionists send a 'message to their fellow scientists … either [to] get on the bandwagon or [to] be left behind… Antireductionists would not be calling for pluralism [of methods] if they had any chance of winning'.

It seems highly unlikely that systems biologists, who seem to be the best biological candidates for antireductionists, would deny the enormous importance of reductonism in biology's past, present or future. The combative tenor is maintained in several chapters, interrupted by historical accounts of diverse biological subspecialties, by what appear to be streams of consciousness, and by grumpy ranting, such as: 'Because [molecular biologists] haven't been taught the hard stuff [such as evolution or ecology], they get the fun stuff and think that this is all there is' (p. 175), or 'reductionists think that we can actually make progress in science' (p. 165).

After reading *Reductionism…*, one might agree with Rosenberg's first statement on page 126 that 'Biologists are unlikely to be interested in philosophical disputes about the nature of explanation', but not with his second: 'Regrettably, they will have to be, if they wish to decide intelligently about whether to embrace a reductionist or nonreductionist methodology'.

In light of Van Regenmortel's comment (p. 356) that 'you never ever find the ultimate explanation' – and of Heisenberg's well-known insights about uncertainty – it seems that practicing biologists, whether reductionist or systems-oriented, don't do as badly in 'explaining' the functioning of cells and organisms as the reader is led to believe throughout most of the book.

Reference

1 von Bertalanffy, L. (1968) *General Systems Theory*, George Braziller, New York

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