

ORGANISM AND MECHANISM

A Critique of Mechanistic Thinking in Biology

**Submitted by Daniel James Nicholson to the University of Exeter
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ABSTRACT

In this thesis I present a critical examination of the role played by mechanistic ideas in shaping our understanding of living systems. I draw on a combination of historical, philosophical, and scientific resources to uncover a number of problems which I take to result from the adoption of mechanistic thinking in biology.

I provide an analysis of the historical development of the conflict between mechanistic and vitalistic conceptions of life since the seventeenth century, and I argue that the basic terms of this conflict remain central to current disputes over the nature of the organism as well as the question of how far the theories, concepts, and methods of physics, chemistry, and engineering can ultimately take us in the explanation of life.

I offer a detailed critique of the machine conception of the organism, which constitutes the central unifying idea of mechanistic biology. I argue that this notion, despite its undeniable heuristic value, is fundamentally inadequate as a theory of the organism due to a number of basic differences between organisms and machines. Ultimately, I suggest that the neglected vitalistic tradition in biology actually possesses the best conceptual tools for coming to terms with the nature of living systems.

I also undertake a philosophical analysis of the concept of mechanism in biology. I argue that the term 'mechanism' is actually an umbrella term for three distinct notions, which are unfortunately conflated in philosophical discussions. I explore the relation between mechanistic biology and the new philosophical interest in the concept of mechanism and I show that these two research programs have little to do with one another because each of them understands the concept of mechanism in a different way.

Finally, I draw on the historical and philosophical foundations of cell theory to propose an epistemological perspective which enables the reductionistic explanation of the organism without having to give up the distinctive features of life in the process. In this way, I show this perspective to have significant advantages over the classic physicochemical reductionism of mechanistic biology.

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Although I cannot speak from personal experience, it seems to me that the process of writing a doctoral thesis is quite similar to having a baby. It is slow, painful, laden with uncertainty, and very hard work. However, all the effort seems worthwhile as you see how your creation gradually acquires a life of its own.

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“Present day biology is the realization of the famous metaphor of the organism as a *bête-machine* elaborated by Descartes in Part V of the *Discours*”

Richard Lewontin (2009)

“There are powerful reasons for thinking that emancipation from the mechanistic paradigm is a precondition for true insight into the nature of biological processes”

John Dupré (2007)