

Book review

The Misunderstood Gene

M Morange

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Michel Morange's book, *The Misunderstood Gene*, newly translated into English and revised, provides a helpful perspective on the recent avalanche of information about genetics and biology. The book's particular virtue lies in its application of a conceptual system that suitably integrates the molecular, cellular, and organismic levels of biological systems. Morange employs the new epistemological tools developed in the late twentieth century under a variety of rubrics – chaos theory, post-structuralism, organizational and systems theory – which permit the integration of different types of data from different levels of organizational structures. He appropriates the utility of these tools, however, with a vigorous rejection of the relativism with which they are popularly associated. The combination brings forward a new and powerful conceptual tool for biological theory.

Morange begins on a crusty note that may be off-putting for humanists as well as some biologists. Initially, the book seems aimed as a sally against the unnamed 'opponents' of biology. Morange uses the opening chapters, which provide a brief history of genetics research, as an argument that the term 'gene' is useful and ought to be sustained. While he admits that genes are not physically discrete entities, and that different sub-fields must use the term differently for their varying purposes, he argues that the reification of genes 'was not the result of a scientific strategy but rather of a series of unexpected findings' (p 15). He insists, moreover, that genes are, after-all, unavoidably important to biological processes and that extragenic inheritance does not exist (pp 36–37).

Having made these defensive points, however, Morange moves on to summarize much of the literature demonstrating that genes are not simple determinism-machines, and, in fact, are only one component of the story of biological life. He emphasizes, as others have, that genes are 'dead letters' and that proteins are the active agents in biology. In his accounts of recent studies using knock-out mutations, Morange shows how genes matter, but that they do so in indirect and complicated ways. He emphasizes the processes through which genes interact with each other and with the other components of the cell.

Three major concepts emerge from Morange's analysis of recent research. First, biological systems are structured at three levels – molecular, cellular, and organismic – and all of these levels of organization are important in a causal sense. Moreover, the interactions between the levels of these structures are also important. Thus, biology is not simply reducible to molecular action, especially in terms of prediction. Second, genes do not act in a simple

fashion to produce organismic level functions. Genes are pleiotropic, even 'promiscuous', executing multiple functions in different stages of development, in different organisms, or even in the same organism at the same time.

Finally, few genes are all-powerful, because cells and organisms use multiple genes to achieve their functions, and they have developed compensatory mechanisms and/or genetic redundancy, both at the immediate functional level and through developmental processes. Thus, knocking out supposedly essential genes often produces non-lethal results, because the cell or organism is able to compensate in other ways. As a consequence of these three features of biological systems, the path from gene to phenotypic effect generally produces many surprises, vitiating the ability to predict neatly the action of genes in organisms. So much for the all-powerful and selfish gene.

In its closing chapters, *The Misunderstood Gene* then moves into the sticky areas of human behaviour, longevity, and the eugenic implications of genetics research. Morange explores large chunks of the existing research, much of which illustrates his theme, that genes matter, but in indirect and complicated ways. Longevity clearly exemplifies the principles of complexity Morange has articulated.

Programmed cell death is essential for some organismal development, but there are no 'genes for' organismal death. Longevity is associated with particular alleles, but these alleles are not 'long life' genes; they operate in various ways in general organismic activities.

Morange's analysis may be most useful as he applies it to human behavioural genetics. He shows the ways in which 'although genes can be involved in making behaviors possible, they do not control them' (p 136). *The Misunderstood Gene* offers a sophisticated understanding of the nature of the action of genes in biology, and in the final chapter it employs this analysis to counter those advocates who hold that attention to genes is inevitably reductionistic and therefore a giant step down the path to Nazi-style eugenics. The book will surely not convince the most reductionist of biologists nor convert the most skeptical critics of biologism. However, for the rest of us, it models useful vocabularies for restructuring our thinking about the role of genes in human life, avoiding both reductive determinism and formless relativism or vitalism. Regrettably, non-scientists will not find this an easy or inviting read, while scientists may think that some of the accounts are too severely truncated, when they are not made simply wrong by breaking developments. For both audiences, however, the effort and tolerance are worthwhile to forward a dialogue about how we ought to understand our genes, and for what that understanding means for the ways in which we are forming our social lives together.

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