Book Review: An Anti-Neo-Darwinian View of Evolution

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Biological Emergences: Evolution by Natural Experiment. Robert G. B. Reid. (2007, Cambridge, MA: MIT Press.) $38.00, £23.95, xv + 517 pages. Index. ISBN-10: 0-262-18257-2 (cloth: alk. paper); ISBN-13: 978-0-262-18257-7 (paper: alk. paper).

We have here a text that fervently proclaims its disagreement with the neo-Darwinian orthodoxy in evolutionary biology. As a materialist, the author sees the modeling of gene pools to be playing with abstractions that represent changes that happen after evolution has already occurred. He expends a good deal of word play on disparaging the selectionist orthodoxy. The writing in places tends toward the turgid—an "entangled bank" of words and concepts! This perhaps reflects the complexity of internal and external factors involved in the emergence of phenotypic novelty that the author takes to be the real action in evolutionary change.

The author deploys four main clusters of arguments:

1. He attacks the notion that natural selection is a force or cause, rather than a secondary effect, of evolutionary change. He notes that some types would be favored by selection because they function better in existing conditions, rather than, as in the neo-Darwinian view, taking some types to be better because they are found to be favored by selection, which just reifies an operational definition of "better." As I have put it myself, "selection only disposes what self-organization proposes." It is the proposing that is the creative basis—and the more problematic and interesting aspect—of biological evolution. He does not impugn the selection model itself. In fact, he does not leave the neo-Darwinian framework, but reinterprets it, "reinventing" natural selection's role.

He views selection as a process actually opposing evolution, seeing it as a representation of a centripetal tendency in the gene pool, which preserves current genotypic configurations that represent adaptedness. This just emphasizes the standard Hardy-Weinberg "law" to the effect that, if no perturbations act to change gene frequencies, they won't change, even though the selective effect is always present inasmuch as populations can't just keep growing endlessly. Evolutionary change, as a result of phenotypic exploration, is taken to be favored best when populations are released from competition, either internally or externally, a situation that tends to follow catastrophic environmental perturbations. The author thinks the selective effect would be reduced in those circumstances.

Concerning the forces of change, he claims that genetic change does not precede evolution by way of mutations, but occurs after a phenotypic change, fixing it in the genetic information storage, much as in the Baldwin effect (which he does not cite by name even while using the idea). This effect is the fixation of the alleles at the suite of genetic loci that happened to be operative during the time of emergence of a successful new phenotypic trait. His chapters on emergence are unremarkable, noting with many examples that both intrinsic and extrinsic factors need to be considered.

Thus, he rejects the neo-Darwinian "randomness" of evolutionary change, which is imposed by requiring genetic change to occur before it might have an evolutionary effect, so as to obviate the possibility of directed mutations. Instead, he favors change caused by arbitrary actions by, or within,

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the organism. From a modeling point of view, this would not indicate any change in logic, since there is no formal difference between a random event and an arbitrary action, both being unrelated to upcoming organismic needs.

His view is organism-centered (basically, animal-centered), even though he touts hierarchical structure and modularity, and even sees the origins of new levels as a primary result of evolutionary change, as in endosymbiosis or in the origin of multicellularity.

2. The author sees evolutionary change as alteration of the phenotype, either as internally self-organized, or as an externally triggered internal reaction ("physiogenesis") of the organism. He is concerned only with the origin of phenotypic novelty as representing the core of organic evolution. Since the tinkering involved has no general properties, neo-Darwinians just take this search among possibilities as random (with respect to organismic needs).

He sees new forms and behaviors to result from (a) embryonic "experimentations" as sometimes studied in evo-devo and its earlier progenitors, as well as (b) various cell-mediated chromatin modifications resulting in altered gene regulation, such as are studied in epigenetics. He has a valuable review of the literature on these topics at all levels within the organism, and this may be the best part of the book as an exercise of scholarship in the service of advocacy. It is instructive to see that some ideas have appeared over and over again as though implicit in the discourse.

He shows a special interest in orthogenesis (explored in an entire chapter) insofar as that suggests some kind of internal drive to change, demonstrating in that case the agency of the organism in evolution—this rather than seeing directional evolutionary trends as a result of a neo-Darwinian slow tracking of some continuing environmental change. Orthogenesis forefronts the evolution of specific traits, something that is actually problematic but unacknowledged as such in the neo-Darwinian framework.

So he favors a generally Lamarckian view of evolution as a progressive tendency toward improved adaptability—a holistic property not tied to particular traits—which gets delayed and obscured by the frictional necessity for adaptation along the way.

And so, evolution does not equal natural selection. Evolution is taken to be progressive changes in organisms, resulting always in improved adaptability. Thus it tends to maximize adaptability rather than adaptation-oriented fitness. It is interesting to note that in this he implicitly makes a valuation—that evolution is good. Thus, evolution "increases freedom" to act, and selection is bad because it impedes this progress.

3. The author argues that the emergence of new traits is logically likely to be saltatory rather than acquired in the slow gradualism favored in neo-Darwinism. The change would be accommodated by developmental integration into the existing system, fostered by phenotypic plasticity. If successful, this would be followed by a long period of genetic assimilation characterized by normalizing selection—a period of phenotypic stasis that he denies as being evolutionary at all, even though genetic changes accrue during this period. Thus, selection, following as a matter of course, is viewed as redundant with respect to understanding evolutionary change. While retaining the neo-Darwinian framework, the book is both anti-gradualist and anti-genetic-reductionist.

4. The author acknowledges three general arenas wherein change gets initiated—as a result of associations (of cells or organisms), as a result of developmental explorations, and as physiological or behavioral changes generated upon encountering new environmental conditions. These could be viewed as a cycle, thus: epigenetic excursions → behavioral change → new associations → epigenetic change at a new level → · · ·. But, based in his materialist-dialectical perspective, he tends to be against general perspectives, referring to these disparagingly as "systems reductionist." (He does, however, admire and frequently refer to the simulations of John Holland.)

Delving into the *mechanisms* of phenotypic change, he finds each case to involve its own particularities. He finds no general rules of novelty generation. Materialism, in this context, notes that systems models might work only because they implicitly rely on unstated material properties of the world. Since important material conditions involve situations, which are always historically mediated configurations, he is invoking historicity, or path dependence, here joining the neo-Darwinians. Thus, if the tape were to be run again, the results could be significantly different. This

implies agent-based modeling, where one might look for the emergence of cooperative configurations that may serve to launch yet others at still higher levels.

Among non-neo-Darwinian concepts, he ignores widespread evidence of convergent evolution, found at both organismic and ecological levels. In this, he once again joins the neo-Darwinians themselves. For him, this avoidance is presumably because convergence would suggest structural attractors, which would undercut the primacy of organismic agency in the view of evolution that he champions. For neo-Darwinians, the idea of deep structures opens up the unpleasant possibility of control of evolution by external agency.

I can recommend this book for its rich discussion of aspects of evolutionary discourse that had been dropped out of Darwinian evolutionary biology by the neo-Darwinians, but are now being reexamined by investigators like Warren Arthur, John Gerhart, Brian Goodwin, Mark Kirschner, Gerd Müller, Stuart Newman, and Mary Jane West-Eberhard among others, all of whom are cited and discussed, so that even though the book is quite historically connected, it is also quite up-to-date.