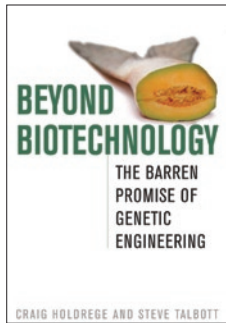


Context, context, context! A delicate empiricism for biotechnology



Beyond Biotechnology: The Barren Promise of Genetic Engineering

by Craig Holdrege & Steve Talbott

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Reviewed by Lenny Moss

Might the genome of the sloth be a potential goldmine for finding cures for youthful hyperactivity? While this proposition will strike some as a sardonic *reductio ad absurdum*, for many others it will simply resonate with widespread contemporary understanding and expectations. Although much of the upshot of comparative genomics has been to reveal the surprising fungibility of genetic parts across kingdoms and phyla and the concomitant significance of developmental (or 'systems') context, these insights have yet to be consolidated into a new 'vision' of nature or of the organism¹. If this insightful new book receives the attention it deserves, the sloth may well become the poster child for just such a new vision.

The moral of Holdrege and Talbott's story is that biological context is important. The sloth owes its slowness to systematic properties such as a very high ratio of retractor to extensor muscles (good for hanging but poor for supporting one's weight), to a low overall ratio of muscle to body mass, to its reliance upon ambient temperature to regulate its rate of metabolism and to an unusually large and perennially full stomach that obviates the experience of hunger. Contrary to any gene-for-slowness concept, it is unlikely that so much as a single gene of the sloth is in and of itself a cause of slowness such that it could not equally well contribute to a 'fast' life-form given a different context.

Too much of the public debate about biotech has been merely a shallow volley between those working two sides of what amounts to essentially the same street—the gene-tech boosters and/or self-styled 'transhumanists' on the one side and the pious bioconservatives on the other. To the extent to which both sides share the same, largely tacit, reductionist vision of the organism, Holdrege and Talbott proffer a plague upon both their houses. Jürgen Habermas² and Bill McKibben, for example, have both targeted the consequences of

'programmed' enhancements, of things such as musical or athletic ability in one's children. Where Habermas has helped himself to the idiom of genetic determinism to decry the potential loss of the self-determining symmetry conditions he takes to be requisite to moral autonomy³, McKibben has set his sights on questions of personal authenticity. A mother, for example, who programs talent for the piano into her daughter "robs her daughter forever of the chance to make music her own authentic context—or to choose something else." Likewise for McKibben, a monk who had been programmed for piety "...would be, for all intents and purposes, a robot." But, as Holdrege and Talbott point out, "if this is true—if we are, in this mechanistic sense, creatures of our DNA—then we are robots in any case. An entity that can be programmed is already an automaton. That's what it *means* to be an automaton. What difference does it make whether 'chance events' programmed us, or whether someone in a lab coat did? If, as McKibben insistently repeats, a twiddled bit of DNA substitutes for your meaningful self, then so too does an untwiddled piece of DNA." So much for the bioconservative 'critique' of biotechnology.

For those seeking practical implications, the best the book has to offer are to be found in the early discussion of genetic engineering and agriculture. The targets are attempts to treat phenotypic outcomes as narrowly isolatable phenomena with better solutions to be found in thinking ecologically and systematically at every relevant level of analysis. Tweaking a single pathway in the sugar metabolism of the potato, for example, resulted in altering the production of not just one metabolite but of 88 different substances. Engineered boosting of carotene production unpredictably also resulted in producing a dwarf tomato. The dangers of techno-fix tunnel vision in addressing the problems of world hunger have been articulated for at least 30 years, but perhaps some of these lessons need to be periodically rehearsed. The benefits of vitamin A-enhanced 'red' rice can only be assessed in a context that includes both the symbolic significance of white rice on the Asian family table as well as the presence or absence of requisite amounts of fats and proteins in the larger diet necessary for putting increased amounts of vitamin A to metabolic good use.

On the positive side of the ledger, the benefits of thinking contextually can be seen in low-tech breakthroughs in integrated pest management that manage to deliver more for less. In lieu of herbicide-resistant, genetically engineered strains of crops meant for use in herbicide-intensive monocultures, 'push-pull strategies' that combine pest attractor plants on the periphery with leguminous pest-repellent plants in the center can not only spare local ecologies from the onslaught of glyphosphates but even help with nitrogen fixation. Similarly, agricultural experiments in China have identified the complementary effects of interplanting different strains of rice that synergistically reduce fungus-promoting ambient moisture while promoting plant-immune response.

One may well wonder why a book published in 2008, ostensibly about biotechnology, while giving some attention to methods and approaches in agriculture, would say nary a word about such distinctively 21st-century biotech issues as embryonic stem cells. Biotechnology surely must at least tacitly assume a ready vision of the

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nature of the living organism. And in practice when, for example, it constructs a cow as a kind of recombinant 'bioreactor', biotechnology enacts a vision of the nature of the organism. Holdrege and Talbott never meant to provide a detailed examination of the state of the art(s). It is the tacit, yet efficacious, *vision* associated with the assumptions of a reductionist genetics that they are interested in leading us beyond. Living organisms are irreducibly normative systems—susceptible of doing better or worse, of flourishing or not⁴. Understanding how material entities can be normatively (that is, adaptively) self-organizing, in the absence of comfort-food concepts such as that of the 'genetic program', is a challenge that even few contemporary philosophers have found the intestinal fortitude to face. While we in the age of 'systems biology' may well all agree in principle that we need to capture the full complexity of the organism in order to understand the contingent and changeable role of its parts, these are hollow words in the absence of an ability to perceive the distinctive full-bodied presence, or as Holdrege and Talbott would prefer—*meaning*—of a particular kind of living being.

Once upon a time there was a German Romantic poet and an accomplished scientist named Goethe who believed that our aesthetic intuitions of nature, coming from the nature of the natural beings that we are, could provide our sciences with cognitive resources and guidance. Under the heading of a 'delicate empiricism' the authors ultimately offer a well-written and engaging attempt at reconstructing just such a context-sensitive approach to biology that can be relevant to our contemporary needs. I would strongly encourage the adoption of this book as core reading for all incoming biotechnology, bioethics and philosophy of biology students alike, albeit with a minor twiddling of the title to that of *Before Biotechnology*.

1. Moss, L. *Philosophy of Science* **73**, 930–946 (2006).
2. Habermas, J. *The Future of Human Nature* (Polity Press, Oxford, UK, 2003).
3. Moss, L. *New Formations* **60**, 139–149 (2007).
4. Moss, L. Detachment, genomics and the nature of being human. in *New Visions of Nature: Complexity and Authenticity* (eds. Drenthen, M., Keulartz, J., Proctor, J.) (Springer International Library of Environmental, Agricultural and Food Ethics, New York; in press).