

The Work of Evelyn Fox Keller as a Resource for Study in Science and Religion

by Kathleen Kordesh

“How things are is, well, *how things are*: our scientific account of Nature, an account of what we can call the Epic of Evolution.”¹

Does it sound strange to read the singularity in the above statement? Is there *a* scientific account of Nature or are there multiple accounts? Biologist Ursula Goodenough wishes to persuade her readers that because there is only one story, then we can and should all get behind it and together solve the ecological crises that threaten us. The goal is worthy and the author is no doubt sincere, but still the words ring untrue. This essay draws attention to the work of Evelyn Fox Keller, Professor of History and Philosophy of Science, Emeritus, at the Massachusetts Institute of Technology (MIT), in the Program in Science, Technology and Society. Keller would argue, contrary to Goodenough, that not only are there multiple scientific accounts (of Nature), but that the various accounts, theories, explanations, do not always rest easily with one another. When convergence of accounts takes place, it may happen for reasons other than that an explanation or a theory objectively fits the evidence best or is most logically coherent. Keller would argue that while science is a unique endeavor in its forms of disciplined encounter with the natural world, scientists are human actors and science is inescapably embedded in human society. This means that some effort is needed to interpret the knowledge that science provides, wherever this knowledge is encountered.

The connection between Keller’s work and the science and religion dialog is indirect, perhaps one step removed, but very important for what it has to say, not only about the biological sciences, but all of science. Her work yields insights about technology, ethics, the nature of life or living organisms, and about how we know what we know, or what counts as knowledge.

It should be of great value to students in theology and ethics as they engage in a dialog with science and, in particular, with those aspects of the dialog that deal with the powerful and pervasive influences of science and technology on human society and on all life on earth. Keller’s work provides critical tools needed to interpret and evaluate scientific knowledge and the technology that is developed from such knowledge. It contributes a critical new perspective to a growing dimension of the science and religion dialog, which emphasizes relevance to sustainable human societies.

Having begun her career as a working scientist, first in physics, then biology, Keller’s appreciation for scientific achievement and the phenomenal productivity of science based on firsthand experience adds to the plausibility and significance of her insights in contrast to another prevalent viewpoint that would interpret any scientific knowledge as socially constructed. Keller does an exceptional job of neither going the way of some social studies of science that ignore the actual accomplishments of science, nor reflexively accepting scientific explanation as transparent truth.

Although this type of work is sometimes seen as merely threatening to undermine rationality and even the possibility of doing science, it can also be seen as suggesting that the world of science is in reality many worlds and quite a bit more subtle and, therefore, interesting. It could even be said that it makes science seem more up to the task of understanding the subtlety and complexity of the natural world. Students of theology who reflect on scientific knowledge and what it means for theology should feel at ease with a more nuanced understanding

¹ Ursula Goodenough, *The Sacred Depths of Nature* (New York: Oxford University Press, 1998), xvi.

of the sciences. A real difficulty might be that Keller's work is highly technical at times and challenging for a non-scientist. However, Keller gives the reader enough information to understand her arguments.

The main purpose of this essay is to recommend important, fundamental, and engaging reading in the history, philosophy and social studies of science for those entering or already involved in the science and religion dialog. Both science and religion play important roles in the converging ecological crises that we all face today. Both bear responsibility, but also provide critically important resources. Keller notes that if science has served particular needs and interests, some of which have led into the ecological crisis, then it is also true that science could serve other needs and interests that would lead to a better society for all living creatures and the earth itself.

The remainder of this essay examines six of Keller's books in chronological order of publication and highlights some key ideas in each. In addition, two edited collections are recommended as guides to further reading. *A Feeling for the Organism* (10th anniversary ed., New York: W.H. Freeman, 1993), a biography of geneticist Barbara McClintock, is Keller's first book length work. The title describes the particular character of McClintock's approach to her work, which served to distinguish it from the removed stance of a typical, "model" scientist. Although Barbara McClintock was a highly regarded biologist, recognized for both her dedication and her creativity, midway through her career she found herself working in isolation from her scientific community. Then much later, when McClintock was eighty-one years old, she was awarded the Nobel Prize in Physiology or Medicine.² Keller recognized McClintock's story as one that needed to be told. The issues raised became themes throughout Keller's writings, with questions becoming broader over time, as in: "Why are some explanations preferred over others?" and "What counts as knowledge?"

McClintock felt that the intimate relationship that developed between her and the organisms that she studied was an essential part of her method, but was it also a factor in her isolation? Keller suggests that it might have been in the following way. McClintock's isolation coincided with the phenomenal early successes of molecular biology. Molecular biologists had, as they put it at the time, "cracked the genetic code" and the mechanism they discovered was "stunning in its simplicity."³ McClintock was in a sense on the opposite track discovering increasingly complex mechanisms. "For her the discovery of transposition was above all a key to the complexity of genetic organization—an indicator of the subtlety with which cytoplasm, membranes, and DNA are integrated into a single structure."⁴ She had a particular aim in mind, which others did not seem to share, but which meant that she could not help but always try to take more into account. She was well aware of the danger in not considering the complex web of relationships that ties all things to each other. "Technology is fine, but the scientists and engineers only partially think through their problems. They solve certain aspects, but not the total, and as a consequence it is slapping us back in the face very hard."⁵ McClintock hoped that the discoveries that she had made would encourage a return to "an approach that does not press nature with leading questions but dwells patiently in the variety and complexity of organisms."⁶

By the time Keller published *Reflections on Gender and Science* (New Haven: Yale University Press, 1985) she had

2 *World Almanac and Book of Facts* (New York: Newspaper Enterprise Association, 1984), 33.

3 Evelyn Fox Keller, *The Century of the Gene* (Cambridge, Mass.: Harvard University Press, 2000), 54.

4 Evelyn Fox Keller, *A Feeling for the Organism: The Life and Work of Barbara McClintock*, 10th anniversary ed., (New York: W.H. Freeman, 1993), 199.

5 *Ibid.*, 206.

6 *Ibid.*, 207.

made the transition in her working life from mathematical biophysicist to historian and philosopher of science. In this collection of essays Keller begins to map the relationships between gender and science. The questions of interest are now, as she states in her introduction, “How much of the nature of science is bound up with the idea of masculinity, and what would it mean for science if it were otherwise?”⁷ She seeks answers in history (Part 1: Historical Couplings of Mind and Nature), psychology (Part 2: The Inner World of Subjects and Objects) and philosophy (Part 3: Theory, Practice and Ideology in the Making of Science). This is a groundbreaking collection of texts on gender and science that should be read by anyone interested in this area.

Her second collection of essays, *Secrets of Life, Secrets of Death: Essays on Language, Gender, and Science* (New York: Routledge, 1992) is, like *Reflections*, organized into three parts. Part one is an update on gender and science; part two is a series of articles that explores the various meanings and usages of the word secrets, as in secrets of nature, of life, and of death. Part three examines evolutionary theory and provides several examples of how language acts as the vehicle through which societal and individual needs and preferences enter into scientific investigation. This collection emphasizes the devastating effects of what Keller calls the “technologies of life and death.”⁸ Her intention is to show how this state of affairs is not unalterable. She concludes her essay, “Critical Silences in Scientific Discourse” with the following: “I have no doubt that, with sufficient interest, we could develop representations of natural phenomena adequate to the task of changing the world in different ways—perhaps, as some have hoped, giving us solar energy, rather than nuclear power; ecological rather than pathogenic medicine; better rearing rather than better breeding of our offspring.”⁹

A significant development in the later collection of essays is a stronger emphasis on the relationship between language and science. Keller writes, “Different metaphors of mind, nature, and the relation between them, reflect different psychological stances of observer to observed; these, in turn, give rise to different cognitive perspectives—to different aims, questions, and even to different methodological and explanatory preferences.”¹⁰ An important point is that science is not exempt from these considerations, although most scientists are trained to believe that it is. As Keller points out, even a metaphor as basic to science as the “laws of nature” carries with it a sense of nature obeying from below laws imposed from above,¹¹ yet most scientists would not consider how this might affect how questions concerning the natural world are formulated.

Another work, *Refiguring Life: Metaphors of Twentieth-Century Biology* (New York: Columbia University Press, 1995) is a short volume that consists of three essays based on the Wellek Library Lectures in Critical Theory delivered in June 1993 “in the heartland of the ‘other’ culture.”¹² The essays concern language and science and Keller delivers her message not in the abstract, but by narrating current and historical developments in science that illustrate the functioning of language in science. The first essay in the volume examines what Keller calls the “discourse of gene action.” She draws an analogy between this discourse and a once prevalent way of thinking about biological fertilization.¹³ She asks “What does attributing (or for that matter denying) causal power to genes

⁷ Evelyn Fox Keller, *Reflections on Gender and Science* (New Haven: Yale University Press, 1985), 3.

⁸ Evelyn Fox Keller, *Secrets of Life, Secrets of Death: Essays on Language, Gender and Science* (New York: Routledge, 1992), 9.

⁹ *Ibid.*, 92.

¹⁰ *Ibid.*, 31.

¹¹ *Ibid.*, 30.

¹² Evelyn Fox Keller, *Refiguring Life: Metaphors of Twentieth-Century Biology*, The Wellek Library Lecture Series at the University of California, Irvine (New York: Columbia University Press, 1995), ix.

¹³ *Ibid.*, xii-xiv.

mean?”¹⁴ The second essay looks at the problem of life and the second law of thermodynamics (or law of increasing entropy) and the kinds of solutions proposed to account for the ways in which life appears to defy the second law. This leads to the question “What is life?” The third essay considers what has happened to the body in biology as guiding metaphors shift from the clock in the seventeenth century, to the steam engine in the nineteenth century to the computer of the twentieth century. Keller ends the first essay on a positive note, stating that the “complexity and agency of the organismic body is finally being accorded its due.” By the third essay (“The Body of a New Machine”), which concerns our contemporary situation, she cautions that now we find ourselves with a very different sort of organismic body to consider. Throughout Keller asks about the role played by scientific metaphors. How do they function to guide science and how do they reflect the shifts in social and cultural contexts in which science takes place? If one decided to embark on a study of Keller’s work, there is good reason to start with this book. Each chapter is self-contained, instructive and entertaining to read. They teach about science by example, and that might be the easiest way at first to grasp her messages and meanings.

In *The Century of the Gene* (Cambridge, Mass.: Harvard University Press, 2000) Keller becomes more focused on the history of genetics, embryology (or developmental biology) and molecular biology. The subfield of biology that we know as genetics originated at the beginning of the twentieth century. The title Keller chose for this book suggests the question, if the twentieth century was the century of the gene, of what is the twenty-first century? Keller traces the history of genetics with a particular focus on the *uses* of the term gene. Chapter one, “The Life of a Powerful Word,” describes how when the term gene was first proposed it was a purely hypothetical entity, needed as a way to pursue an understanding of heredity. It was readily acknowledged to have no known basis in material reality. Keller calls the “discourse of gene action” the “way of talking that at least tacitly granted to genes the power to act, even in the absence of any information about *how* they might act. This same way of talking endowed the gene with a most curious constellation of properties. At one and the same time, the gene was bestowed with the properties of materiality, agency, life, and mind.”¹⁵ One needs to read Keller’s account of developments in molecular biology during the 1950s and 1960s to get a clear picture of what happened. When evidence was found that genes were not always actors, but acted upon, the possibility that causal agency might not be located entirely with the genome was raised. This challenge was met with the concept of “gene activation” and a powerful metaphor, the genetic program. Keller writes (with more than a hint of sarcasm), “genes may need to be activated, but other genes—regulator genes—were there to do the job.”¹⁶ This “put genes back in the driver’s seat and traditional expectations of genetic control safely back on track.”¹⁷ Since that time, the picture has become very much more complicated still.

Keller argues that although the term gene no longer carries much in the way of biological meaning,¹⁸ gene talk will remain. Among the reasons given is that “gene talk is an undeniably powerful tool of persuasion, useful not only in promoting research agendas and securing funding but also (perhaps especially) in marketing the products of a rapidly expanding biotech industry.”¹⁹ In the final paragraph she writes, “if the term *gene* has become a hindrance to the understanding of biologists, it has perhaps become even more of a hindrance to the understanding of lay

¹⁴ Ibid., 3.

¹⁵ Evelyn Fox Keller, *The Century of the Gene* (Cambridge, Mass.: Harvard University Press, 2000), 46-47.

¹⁶ Ibid., 80.

¹⁷ Ibid., 80.

¹⁸ Ibid., 8.

¹⁹ Ibid., 10.

readers, misleading as often as it informs. As a consequence, it shapes popular hopes and anxieties in ways that are often off target, and in fact counter-productive to effective discussion of public policy even where the issues are real and urgent.”²⁰

In the first sentence of the preface to her most recently published book *Making Sense of Life* (Cambridge, Mass.: Harvard University Press, 2002) Keller states the core question of the book, “How does an organism come to be?”²¹ Keller looks to history, a method characteristic of her work, to examine what sorts of explanations have been given and why some explanations have been quite decidedly preferred over others. This question came to the fore when she was working on *A Feeling for the Organism*, the book about geneticist Barbara McClintock discussed above: “I sought an understanding of why McClintock remained so deeply unsatisfied by efforts to explain biological development in terms of the central dogma of early molecular biology—efforts that many others clearly did find satisfying.”²²

Making Sense of Life is not an easy book to read and understand, but it contains profound insights about science, the life sciences, in particular. Have biologists made sense of life or of how an organism comes to be? Keller would say not by any means and there is no reason why biologists should believe that they ever will. If complete knowledge and understanding of how an organism comes to be was within the grasp of human science, this would also imply complete power over this process. Keller asserts, however, that absolute understanding of life is not likely to ever be within the grasp of science. The natural world is too complex and acceptance of this might be the ground for fostering a more equitable relationship between scientists and the organisms they study. Although Keller doesn’t state this explicitly, it might also result in more honest and realistic reporting of science for public consideration.

Keller’s most critical tool is her close study of how language functions in science. Scientists use language in a similar way as everyone else, which means that ambiguities of language are as common in science as elsewhere. As she shows time and again these ambiguities can turn out to be quite productive; for example, they allow scientists to put aside unanswerable questions and attend to those that they can attend to.²³ However, what is good for scientific productivity might turn out to have harmful consequences if incomplete understanding is mistaken for the greater understanding that is often assumed when science becomes technology.

Keller has co-edited several collections of essays and two are noted here. *Feminism and Science* (Oxford: Oxford University Press, 1995) contains seventeen articles by feminist scholars and as such would be a good volume to use to extend study beyond Keller’s work or to get an overview of the field. A nice feature of the book is a collection of recommended readings organized by subject area: feminism and science; science, language and metaphor; philosophy of science; science studies; and feminist theory of knowledge.

Keller refers to *Keywords in Evolutionary Biology* (Cambridge, Mass.: Harvard University Press, 1992) often in her other books and essays. The title recalls the book titled “Keywords” by Raymond Williams.²⁴ The editors cite Williams for alerting them to the “social, political, and intellectual value of exploring the multiple and shifting meanings of familiar terms.”²⁵ Each of fifty-one short articles is written by a biologist or philosopher of science.

²⁰ Ibid., 148.

²¹ Evelyn Fox Keller, *Making Sense of Life: Explaining Biological Development with Models, Metaphors, and Machines* (Cambridge, Mass.: Harvard University Press, 2002), vii.

²² Ibid., viii.

²³ Ibid., See discussion of the concept of the genetic program in chapter four, 135-145.

²⁴ Raymond Williams, *Keywords: A Vocabulary of Culture and Society*, Rev. ed. (New York: Oxford University Press, 1985).

²⁵ Evelyn Fox Keller and Elisabeth A. Lloyd, *Keywords in Evolutionary Biology* (Cambridge, Mass.: Harvard University Press, 1992), 4.

Some words are treated in two articles, one giving “historical perspective,” the other “current usages.” Keywords range from “adaptation” and “altruism” to “teleology” and “unit of selection.”

In summary, Keller’s work could be read with many ends in mind. This essay has attempted to focus on the general question of how science works in order for nonscientists to better assess the science they encounter in whatever context, but, in particular, in the science and religion dialog. Her work has many important ethical implications regarding the use of biotechnology. Perhaps, most important for theology, is the insight gained on scientific claims to understand life. According to Keller, this is very much an open question and is likely to remain forever so. This can only be good news for aspiring theologians, who are free to bring their own insights to bear on this question of fundamental importance.

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