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Book review

Things Come to Life. Spontaneous Generation Revisited

by Henry Harris

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Virtually all Western religions assert that, in the beginning, all life arose from formless materials in the earth, or sea. It was an act of creation due to some kind of divine intervention, and, for whatever reason, it was not to be repeated. Once generated, plants and animals reproduced by seed. Still, there were other, smaller creatures whose reproduction remained obscure, and this obscurity allowed for the belief that under certain circumstances, inanimate matter could generate life spontaneously by a natural process. And this idea persisted for millennia.

In *Things Come to Life*, Henry Harris takes us on a quick tour of the history of spontaneous generation debates, the theological and philosophical preconceptions underlying them, and the sometimes ingenious experimental designs used to test contending assertions. As it was for Aristotle in the 4th century BCE, so it was to William Harvey in the 17th century, spontaneous generation was one of two ways in which some animals could be generated, the other was from parents. The durability of these beliefs, he argues, came from two related factors, the ecclesiastic scholasticism of the middle ages which militated against empirical inquiry and the intellectual dominance of Aristotle. The passing of the centuries did produce a progressively narrowing of the range of creatures still thought to be generated spontaneously. By the time of scientific revolution in the 17th century, with its newly founded empiricism, the only creatures thought to be generated spontaneously were insects. Bees were thought to be generated from the decaying entrails of bulls. But when Francesco Redi experimented with sealed and opened flask, he reported that no grub was produced in the sealed flask, and only flies appeared in the open flasks, no bees.

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While he and other experimentalists in Florence, Bologna and Padua were dismantling the defenses of those who based their support of spontaneous generation on the obscure origin of insects, Antoni van Leeuwenhook, a merchant in Delft, discovered a whole new world of living creatures 'little animals' incomparably smaller than insects. The world of microbes. Their origin by spontaneous generation remained a subject of controversy for another three hundred years.

In Germany early in the 19th century, Harris suggests that both idealists and materialists converged over the belief in spontaneous generation. German idealist philosophers (*Naturphilosophen*) sought principles that would embrace the whole of the natural world (animate to the inanimate) and at the same time, link it to the supernatural. Most *Naturphilosophen* believed that inanimate matter could come to life through the agency of completely natural mechanisms. But some disagreed. Lorenz Oken, for example, argued that life came only from life: *omne vivum e vivo*. Even, those who waged war on the idealists such as Ernst Haeckel took spontaneous generation for granted. His monistic view of life was premised on the assumption that animate and inanimate matter were a continuum governed by the same laws. In the mid century Christian Gottlieb Ehrenberg argued against spontaneous generation on the grounds that *Infusoria* were too complex and that no intermediate forms could be found. Theodor Schwann was ambivalent about it. The theory of Matthias Schleiden and Schwann about cell generation from a fluid containing minute inanimate particles which aggregate into larger units eventually to form the cell was congruent with spontaneous generation. And both theories were opposed by other students of Johannes Muller in Berlin, Robert Remak and Rudolph Virchow who originated the slogan *Omni cellula e cellula*.

French materialists of the 18th century had sided with the belief in some form of spontaneous transition from the inanimate to the animate as a recurrent, natural process. Georges Louis Leclerc Buffon, first director of the Jardin du Roi, was a passionate advocate, and his theories were criticized in a devastating critique by Lazzaro Spallanzani. By mid 19th century, Harris asserts, there was virtual unanimity among savants that spontaneous generation did not occur until Félix Pouchet arrived on the scene with new experimental evidence, and Louis Pasteur challenged him. The contest between Pouchet and Pasteur in the 1860s has been detailed by John Farley and Gerald Geison's classical study (see John Farley, *The Spontaneous Generation Controversy from Descartes to Oparin*, 1974), and by Geison's more recent exploration of Pasteur' experimental and rhetorical style (*The Private Science of Louis Pasteur*, 1995).

Over the past thirty years historians and sociologists of science have given great attention to discerning the nature of experimentation in science; they have also analysed the structure of scientific papers, the rhetorical skills of protagonists in controversies, not to undermine science, but to understand how it

actually works, not by some mythical "scientific method" that eludes definition. Indeed, they have provided a richer more complex view of science, examining the lack of impartiality on both sides. In the spontaneous generation debate, they have shown how religious and social backgrounds of protagonists played a role, how Pasteur allied his views against spontaneous generation with the Church. And recently Geison has pointed to Pasteur's selective reporting of data in published papers.

Harris, a former cell biologist, concedes that personal and religious issues played an important role in the debates. He also agrees that Pasteur was engaged in selective reporting. But so what? After all, he was right? Falsifying reports by omission of data from experiments, Harris argues, is ubiquitous in science. And as other historians have observed, myself included (Jan Sapp, *Where The Truth Lies*, CUP, 1990), he comments that "omission of data from what is finally published merges into falsification only if the conclusion drawn from the work is wrong. If the conclusion is right, the omission is of little interest to anyone by the professional historian scouring discrepancies between the laboratory notebook and the finished paper" (p. 123). Knowing what to include is a matter of personal skill, acquired socially from the community. Harris puts it in somewhat tautological fashion: "Good scientists usually make the right judgement; bad scientists don't" (p. 123). "And on the question of spontaneous generation, Pasteur was almost always right" (p. 124).

Definitively proving the non-existence of something is, of course, an impossible task. But Harris aims to emphasize the importance of experimentation. In doing so, he repeatedly argues against those whom he calls "historians of science" and points especially to Farley's emphasis on the importance of para-scientific issues in the debates. However, Farley, was like Harris himself, educated as an experimental biologist, not as an historian.

Still, Harris's discussion points up the problem about the meaning of experimental results in the controversies over spontaneous generation. He suggests that many experimentalists seemed to be aware of the impossibility disproving a universal negative, Pasteur notwithstanding. Most often, an investigation was undertaken to examine a claim made by someone else that spontaneous generation could indeed be observed under certain specified conditions, and as the investigations proceeded, these condition were refined, new variables delineated, and new sources of error revealed.

The debate over spontaneous generation continued into the 1870s, but this time in England with Henry Charlton Bastion's defence of spontaneous generation and the counter-experiments of Harris's countryman, "the remarkable Irishman" John Tyndall: "If there was anyone who administered a coup mortel to the idea of spontaneous generation, it was Tyndall rather than Pasteur" (p. 155). Yet, Harris knows well that there was no key experiment that locked the controversy away in the annals of science. Bastion argued the

case into the 20th century. As James Strick has shown in his book, *Sparks of Life; Darwinism and the Victorian Debate Over Spontaneous Generation* (2000), not mentioned by Harris, initially, Darwin and his followers entertained the possibility that life could originate suddenly from non living matter, in part based on the evidence Bastion provided.

Thomas Henry Huxley, for example supported this view in his famous essay of 1869 on "T*he Physical Basis of Life.*" But by the 1880s, for a variety of reasons, the Darwinian leaders of biology repudiated the claim of "heterogenesis" (the generation of living organisms from organic precursors) and restricted the question of the origin of life to "abiogenesis" Huxley's word for the generation of organisms from inorganic molecules at the dawn of life on earth.

As Harris' book amply illustrates, the controversies over spontaneous generation teach us a great deal about how social, political, religious and disciplinary concerns interact with empirical research in vital controversies in science.

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