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John H. Zammito. *The Gestation of German Biology: Philosophy and Physiology from Stahl to Schelling.* University of Chicago Press 2017. 560 pp. \$45.00 USD (Hardcover ISBN 9780226520797).

One might question the philosophical relevance of the specialized literature on history of science, especially the literature that deals with positions or movements that have come to be viewed as discredited, such as vitalism or *Naturphilosophie*. I see one important source of such relevance in the fact that many philosophers of science tacitly rely on a certain picture of the history of science that allegedly supports some of their basic assumptions or discredits the contrary positions. In this way, for example, Alexander Rosenberg, while arguing for supervenience of Mendelian phenomena on molecular ones, claims that ‘The history of science and any reasonable epistemology places the burden of proof on such holists’ who deny this supervenience and, more generally, defend the ‘thesis that the whole is ontologically more than or different from the sum of its parts’ (Alexander Rosenberg, *Instrumental Biology, or, The Disunity of Science*, University of Chicago Press 1994, 23). I believe that philosophers who do not primarily work on philosophy of science often tend to assume that we owe most of our achievements in science to reductionism even more vehemently and less cautiously than Rosenberg does.

Such an assumption, however, is an assumption about the history of science, and it can be supported or undermined by research in the history of science. At the very least, serious engagement with the specialist literature would make one wary of claims to the effect that only one particular set of philosophical assumptions is able to ground successful practice in science. More ambitiously, it may show that some commonly despised movements grounded in discarded philosophical positions did in fact lead to major advances in science, thus possibly triggering revisions of *one’s own* philosophical position. I believe that John Zammito’s latest book belongs to the category of historical works that merits engagement for such reasons, among many others. It makes the forceful case for the crucial role of both Enlightenment vitalism and German *Naturphilosophie* in the development and constitution of life sciences. Although by no means the first work in the history of science that makes this case, it is probably the most comprehensive one.

Zammito’s book reconstructs the establishment of biology as a special science with its own distinctive field in the German context. It starts with the discussion of Stahl and his followers at the university of Halle in the late seventeenth century, leads the reader through Stahl’s debate over organism with Leibniz, Albrecht von Haller’s work in physiology, the development of the French vital materialism and German reactions to it, Herder’s and Blumenbach’s crucial work on natural history, to the work of Kiehmeyer, Goethe and Schelling, and of their followers. The book is full of biographical information, analyses of institutional settings, and discussions of political and religious context. It is impossible to convey the richness of detail of a work like this in a review, so I will concentrate on the aspect that is most interesting to me, namely the interactions between science and philosophy, and on that only very selectively.

Throughout this period, one of the main issues for everyone concerned with living organisms was the problem of organic development. Preformationists such as Haller and Bonnet in effect reduced such development to growth and unfolding of the organisms which were all created in all of their complexity together with the world (this theory was later complicated by including the thesis that the growth of different organs may be uneven). This picture, aside from being a *deus ex machina* sort of explanation, faced multiple empirical problems, such as regenerative capacities of living

organisms, interspecies hybrids, monstrous births and even the resemblance between both parents and their offspring.

Epigenesists who rejected this picture faced the problem of explaining the development of seemingly unstructured matter into an embryo, and then a fully formed organism. Some, such as Caspar Friedrich Wolff, postulated forces peculiar to living organisms for this purpose, while claiming that such forces ‘were in “essence” or origin “obscure” and beyond the reach of science, yet they could be postulated on the basis of their palpable effects’ (161). In other words, they did not attempt to give an account of what these forces are in themselves, but only used them as a shorthand for unknown causes of organic development, a stance Zammito associates with the research tradition he calls ‘experimental Newtonianism.’ Other epigenesists like Blumenbach recognized that assuming forces on the model of those employed in physical and chemical explanations does not help much in explaining the goal-directed development, since such forces act blindly, not purposively. For this reason, Blumenbach introduced an essentially purposive agency at work in living creatures, his famous *Bildungstrieb* or formative drive, by which he explained the development of organisms, their nutrition, and regeneration. This contrast between the purposive *Trieb* and blind *Kräfte* was, as Zammito points out, very important ‘both to Blumenbach and to Kant (and, later still, to Goethe and Schelling)’ (212).

Kant, of course, wanted to restrict our use of such teleological concepts to the regulative use only. Zammito argues, however, that Blumenbach and his pupils hardly even understood the Kantian difference between regulative and constitutive principles, let alone accepted it. Goethe, then, found this Kantian distinction unsatisfying and ignored it in his own work. Moreover, Zammito argues that, within the Kantian framework itself, the distinction between the formative drive and formative forces is problematic, although his arguments for this claim seem to be somewhat unconvincing. First, the claim that ‘the formative forces (of general, physical nature) constrain the formative drive in organized life-forms’ (236) seems to be quite compatible with physical nature itself being constrained by a larger purpose, although Zammito seems to find this problematic. Second, the notion of ‘drive’ conceptually differs from that of ‘force’ precisely in being teleological, and it is not obvious that Kant needed anything more to make such a differentiation. Zammito is quite right to raise the question about ‘the ontological status of *immanent purposiveness* in Kant’s transcendental philosophy’ (236), but it is not clear that a Kantian answer cannot be reconstructed on the basis of the ‘Dialectic of the Teleological Power of Judgment.’

Another major question discussed in Zammito’s book is that of the development of the field of ‘natural history’ from a descriptive discipline into the discipline concerned with a causal account of actual historical transformations or, in a catchier formulation, ‘from natural history to history of nature’ (172). Although a short sixth chapter is dedicated to this issue, it resurfaces later in the book as well. Zammito assigns important roles in this process to Buffon, Herder, Kielmeyer and *Naturphilosophen*, with Kant playing a significant but ambiguous role in this development. The first steps in the direction of the history of nature have been made in geology, but these steps were already related to the history of life on Earth by means of the question of the significance of fossils. The existence of the fossils of organisms unlike any currently existing was initially explained by major catastrophic events in the past. However, in his earliest publications, Kant has suggested the principle of actualism, that is, the idea that the forces currently operating in nature are the same that brought it into its current state. Herder went much further in asserting the continuity, including historical continuity, between inorganic nature, various forms of living beings, and man himself, something that Kant found difficult to tolerate. Kielmeyer later suggested a more concrete ‘developmental history of animals’ (256), which was supposed to reveal irreducibly the organic forces at work in this

history and the laws which govern these forces (such as the specific rules of compensation governing sensibility, irritability and reproduction in organisms). Finally, Schelling and other *Naturphilosophen* considered nature as essentially productivity, and not merely a sum of products. Schelling aimed to provide a philosophical reconstruction of various life forms as ‘the gradual development of one and the same original organism’ (315). Although he explicitly pointed out that this project should not be confused with the claim that different species *historically* issue from each other, Zammito argues that Schelling did not reject such a project either. Even if people like Kielmeyer and Schelling themselves did not develop a theory of evolution in its modern form, still less the mechanism of evolution, the idea of evolution *was* suggested in their work.

A philosopher sceptical about the role of the movements such as *Naturphilosophie* in the history of science might point out that it is one thing for a philosophical school to have played a positive role in the constitution of the discipline and quite another for it to have guided scientists to specific empirical or theoretical advances. In this book, Zammito primarily focuses on the former issue, although his discussions of the role of Herder and *Naturphilosophen* in the historization of life sciences are certainly significant for the latter. A more thorough investigation of the fruitfulness of *Naturphilosophie* in the second sense still remains a task, though. Nevertheless, Zammito’s latest book certainly provides an excellent reconstruction of the framework for doing such work on the history of life sciences (and their philosophy).

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