Undisciplined Biology in Twentieth-Century France

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The philosophical problems of knowledge, consciousness, action, form and development, creativity, dynamism, individuality, norm and value, communication, meaning, freedom, and even space and time, are essentially biological problems. — Raymond Ruyer, 1955[1]

In the first half of the twentieth century, the life sciences underwent a series of profound, rapid transformations. From the overturning of preformationism (the theory that embryogenesis was the result of an unfolding of preformed parts), to the Modern Evolutionary Synthesis, which reconciled Mendelian heredity with Darwinian natural selection, to the emergence of molecular biology and the discovery of the structure of DNA, scientific knowledge about life was transformed in mere decades. These conceptual revolutions in the life sciences had major ramifications for French thought and culture.

French philosophers had long been interested in science and epistemology, from Auguste Comte (1798–1857) to Henri Bergson (1859–1941) and Gaston Bachelard (1884–1962). These thinkers saw philosophy as outside of science and therefore able to adjudicate between competing scientific epistemologies. In the twentieth century however, developments in biological science began to make such divisions seem unsustainable, and for French intellectuals born after 1900, biology took on a powerful new valence. Figures like Raymond Aron (1905–1983), Georges Canguilhem (1904–1995), Maurice Merleau-Ponty (1908-1961), and Raymond Ruyer (1902–1987) all understood biology as integral to their own philosophical projects. That is, rather than looking on as outsiders writing chapters in the history of rationality, these mid-century philosophers drew upon contemporary biology as a promising resource for solving the most pressing epistemological, metaphysical, and ontological questions of the day.

What is striking about this interest in biology on the part of mid-century philosophers is that it went beyond the merely instrumental. Experimental results in the fields of genetics, evolutionary biology, and embryology were seen as significant not only for their positive claims, but even more so for their potential as sites of disciplinary reflexivity. The biological became a nexus for reimagining the whole structure of knowledge under a universal and universalizing concept of life, a space for meta-reflection on the nature of knowledge itself.

1. Raymond Ruyer, "La formation du concept de réflexe aux xvii et xviii siècles, par Georges Canguilhem," *Les Études philosophiques*, Nouvelle Série, 10, no. 4 (October 1, 1955): 720. Translations are my own.

Both of these tendencies are visible in the work of Raymond Ruyer. While Ruyer remains a somewhat marginalized figure in the historiography of French thought, he was an influential thinker in his time, and his biological thought made its mark on such luminaries as Gilles Deleuze and Merleau-Ponty. Ruyer trained in philosophy at the École normale supérieure, passing the *agrégation* in 1924. Early in his career he wrote on questions of structure, history, and consciousness, continuing in the metaphysical tradition in which he had been trained.[2] However, Ruyer's philosophical trajectory was dramatically altered by the outbreak of the Second World War, and by his encounter, as a prisoner of war in Austria, with an embryologist named Étienne Wolff.

Ruyer spent almost the entire war in a prisoner-of-war camp on the grounds of former Wehrmacht training barracks in northeastern Austria. The prisoners of Oflag XVII-A, as it was called, enjoyed a relatively high degree of freedom, and were encouraged to keep busy during the long months of captivity.[3] Among the officers at the camp were a good number of academics, and so these men organized lectures on mathematics, philosophy, and biology, among other subjects. They called themselves the *Université en captivité*. Wolff, early in an eminent career as a teratologist (an embryologist focused on abnormalities), held a private, high-level biology seminar that Ruyer attended for more than a year. In his memoirs, Wolff recalled that Ruyer stood out in the group not only because, as a professional philosopher, he was a relative outsider to biology, but also because of his distinctive, at times "paradoxical" approach to biological problems. As Wolff remembered, "[Ruyer] had a precise, if a bit literary, knowledge of biological problems like any scholar trained in the classics without himself having experimented on living matter."[4]

Ruyer's study of embryology at the *Université en captivité* fundamentally transformed his philosophical project. His pre-war philosophy had articulated a universal, mechanist ontology of structure. In the postwar period he moved toward a materialist finalism. His study of embryology under the guidance of Wolff helped him transform his mechanist ontology into the neo-finalist materialism for which he is known. It also helped him resolve a specific problem, that of temporality, which he had been unable to account for in his earliest work.

While this story is interesting in its own right, it also serves as an example of how in the middle of the twentieth century the biological sciences were becoming increasingly central to understandings of history, the human, and the possible limits of knowledge. From the very beginning, Ruyer had been committed to breaking down the boundaries between disciplines. Perhaps this is why he became such an eager participant in Wolff's seminar (though of course we will never know). While Ruyer's earliest work professed a commitment to transdisciplinary epistemology, it was only after putting this commitment into practice as a student of Wolff's that Ruyer was able to fully appreciate the value of traversing disciplinary boundaries.

Long before the war, Ruyer expressed his transdisciplinary ambitions in his 1930 *Esquisse d'une philosophie de la structure*. He had been greatly inspired by the nine-

2. Ruyer's major pre-war works include Raymond Ruyer, *Esquisse d'une philosophie de la structure* (Paris: F. Alcan, 1930); *L'humanité de l'avenir d'après Cournot* (Paris: F. Alcan, 1930); and *La conscience et le corps*, Nouvelle encyclopédie philosophique, [13] (Paris: Librairie Félix Alcan, 1937).

3. Oflag was short for Offizierslager, or officers' camp.

4. Étienne Wolff, Les bases de la tératogénèse expérimentale des vertébrés amniotes, d'après les résultats de méthodes directes (Strasbourg: Les Editions de la Librairie Union, 1936), 119.

teenth-century mathematician, economist, and philosopher Antoine Augustin Cournot. In his *Traité de l'enchaînement des idées fondamentales dans les sciences et dans l'histoire*, Cournot had made a claim for the epistemological primacy of order. He had further argued that knowledge of order (i.e., formal knowledge) was not only more precise than other kinds of knowledge, but was in fact the only true form of knowledge. Intrigued by Cournot's statement that "all we know scientifically are order and form," Ruyer decided to explore this idea to its logical extreme.[5] He believed that Cournot had erred in introducing further concepts, such as force and "vital principle," falsely dividing the world between the organic and the inorganic. Such vitalism, as Ruyer saw it, was to be avoided. Thus in his work on the philosophy of structure, he set out to apply a theory of mechanical structure to all of reality, and to create a unified theory that refused to be circumscribed by disciplinary categories. Describing his own project Ruyer wrote,

Under the hypothesis that everything is defined only by structure, we examine what would become of notions commonly used by philosophers. While Cournot, in his treatise, endeavors to show the distinctions between different orders of reality, between different 'registers,' [i.e.] the logical order from force, matter, and life, to specify these ideas we try by contrast to interpret everything without involving anything but formal structure. We seek to find out whether philosophers are right to reject mechanism in the name of their own [properly philosophical] problems. We want to show that mechanism pushed to the extreme, and used even in domains that hardly seem within its jurisdiction, is not a philosophical doctrine to scorn.[6]

Ruyer clearly had little patience for the boundaries between different forms of knowledge, and therefore paid little heed to territorial claims. He was instead interested in what would happen if one applied a mechanical philosophy of structure to all problems equally, whether scientific or philosophical.

This attempt at a totalizing philosophy of structure resulted in some interesting claims. First of all, for Ruyer, the distinction between life and non-life could not be maintained. Second, and this in part flowed from the former, novelty, and therefore historical temporality, were dramatically curtailed.

At the time that Ruyer was working on his philosophy of structure, vitalism was alive, if not well, in France. Debate about the process of evolution continued to rage, as prominent zoologists continued to seek experimental evidence for their neo-transformist models. In France, institutional biology largely rejected both Darwinian natural selection and Mendelian genetics. Biologists did not believe that evolution could be explained by natural selection. In many cases, they conceded that selection might cause the elimination of disadvantageous traits, but this still could not explain how new traits came into being. They were also often resistant to the Darwinian model of the environment, which they believed imposed an "ultimatum of the milieu," a world in which life was entirely determined by the non-living environment. They were eager, in other words, to defend a theory that posited organisms, not the environment as the engine of evolution. These biologists therefore went to great lengths to experimentally demonstrate transformist mechanisms, in other words, to show that parents could pass on traits acquired during their lifetimes.

5. Antoine Augustin Cournot, *Traité de l'enchaînement des idées fondamentales dans les sciences et dans l'histoire*, vol. 1 (Paris: Hachette, 1861), 3.

6. Raymond Ruyer, *Esquisse d'une philosophie de la structure* (Paris: F. Alcan, 1930), 3–4. Emphasis added.

For reasons that are now perhaps obvious, biologists could not produce any compelling evidence for the inheritance of acquired characteristics.[7] And as a result of the disconnect between theoretical models and experimental results, there was widespread ambiguity around the status of the organism. The resulting subterranean vitalism did not sit well with Ruyer given his commitment to the idea that true knowledge should be all-encompassing, and not limited to narrow jurisdictions. Ruyer believed that the apparent "mystery" of heredity with which biologists had so much trouble was no more than a limit, perhaps soon to be overcome, of observational scale.[8] Cells were just tiny structures, and biologists had confused the limits of their microscopes for the explanatory limits of mechanical science.

The hereditary mechanism could therefore only "create" in the narrowest sense of the word. "Heredity in itself," wrote Ruyer, "is not a force, it is … a simple fact of continuity and similarity."[9] Just as all matter was subject to growth and decay, living beings were born and eventually died. But for Ruyer, in this early period of his philosophy, life itself was not subject to a special causality, it produced no novelty, and it certainly had no special temporality.

Because Ruyer's aim was to demonstrate the plausibility of this universal ontology of structure, when it came to explaining life in these terms he turned to a paradigmatic limit case, that of the embryo. However, before his time as a prisoner of war, Ruyer's knowledge of biology was comparatively thin, and so he saw no complication in the claim that, "the egg invents nothing, it only reproduces the constitution of the species."[10] For Ruyer, the only fatal counter-example to his philosophy "would be a case where movement created an absolutely novel structure," but embryogenesis as he saw it was merely the unfolding of a pre-rigged mechanism.[11] Structures were therefore by definition atemporal. As Ruyer wrote, "once a form, a structure, a mechanism exists, whatever the operation that gave rise to this form, it is what it is."[12]

When a decade later, as a participant in Wolff's biology seminar, Ruyer acquired a deeper familiarity with embryology, he changed his accounts of both structure and temporality to accommodate scientific understanding. Éléments de pschyo-biologie, published in 1946, was largely composed during the war, while Ruyer was in Oflag XVII-A. The book exhibited Ruyer's newfound materialism, and a somewhat attenuated critique of vitalism. In contrast to his previous position in *Esquisse*, Ruyer was now critical not only of vitalism, but of mechanism as well.

In *Éléments*, Ruyer turned to embryology as a resource for thinking about precisely the question left unresolved in his philosophy of structure, the relationship between temporality, finality, and indeterminacy. Experiments on polarity in sea urchins proved especially helpful. In the 1930s, a Swedish embryologist had conducted a series of experiments on fertilized urchin eggs and had shown that it was possible to split two embryos along two different axes and still produce a normally

7. While the rise of epigenetics has arguably vindicated neo-transformist intuitions about the central importance of the environment when it comes to heredity, this argument can only be made in the most general terms. Neo-transformists believed there was a direct somatic transmission of acquired traits, and rejected genetic mechanism as either non-existent or insignificant. For an exploration of this subject, see Snait Gissis and Eva Jablonka, eds., *Transformations of Lamarckism: From Subtle Fluids to Molecular Biology*, Vienna Series in Theoretical Biology (Cambridge, Mass.: MIT Press, 2011).
8. Ruyer, *Esquisse*, 92.
9. Ibid., 93.
10. Ibid., 93.
11. Ibid., 93
12. Ibid., 365.

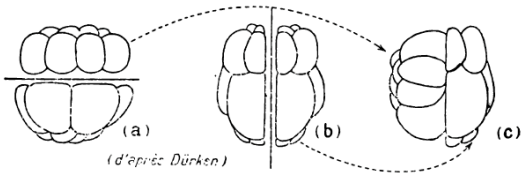

Fig. 12

Éléments de psycho-biologie, p. 73

developing embryo.[13] [see figure above]

This result was interesting in its own right, and consistent with earlier work in the field. But this new work in the 1930s had gone further by demonstrating that this splicing was only possible up to a very specific point in development—it worked at the 16-cell stage, but not at 64 cells. For Ruyer this meant that, "at a certain moment and in certain parts of the embryo, something was therefore produced, which specialized or 'determined' such-and-such cell or such-and-such territory, which could no longer produce just any organ; technique could no longer change its destiny."[14] Spatial fixity turned out to be a phase reached over time, not a property that belonged to the fertilized egg. For Ruyer, this implied a new understanding of the capacity of life to create novelty.

He had little interest, however, in what he saw as "mysterious" finalism, so instead Ruyer turned to a model of psychological memory. Embryology was to be understood as a mnemic, trans-spatial theme, he claimed, writing, "my brain tissue is not differentiated in advance to actualize one memory over another any more than non-determined embryonic tissue is differentiated in advance to provide a leg or a kidney."[15] Like the brain, the embryo did not already contain its future actualization. For Ruyer, embryology therefore introduced a new temporality into the material world, one which was not properly present in his previous philosophy of structure. He now articulated a structure of "dynamic form."

Embryology gave Ruyer, now an avowed materialist, a material description of temporality. And, indeed, this was a self-conscious project on Ruyer's part. He wanted very much to show the continuity of being, and therefore of knowledge, on all scales. His early philosophy of structure offered one approach, but even if one accepted the thoroughgoing mechanism of this theory, Ruyer's first definition of structure was inherently atemporal. It was only by putting his transdisciplinary aspirations into practice that he began to develop a theory of genesis and temporality.

Tracing the trajectory of Ruyer's philosophy of structure from 1930 to 1946 illustrates the importance of biology, not only as an authoritative science, but as an epistemic site for investigating new disciplinary constellations. In the period between 1930 and 1970, the scientific understanding of life was utterly transformed. These discoveries ramified well beyond the laboratory, tumbling disciplinary boundaries that many, though not all, had seen as obstacles to knowledge. Most significantly for scientists, after the discovery of the double helix in 1953 and the molecular turn that accompanied this watershed moment, biologists saw their dream of a unified theory of life within reach.[16] However, as Ruyer's story suggests, the dream of disciplinary unity did not belong to science alone, and in fact it was philosophers who, by peering into the laboratory, first began to pull down its walls.

13. Sven Hörstadius, "The Mechanics of Sea Urchin Development, Studied by Operative Methods," Biological Reviews 14, no. 2 (April 1, 1939): 132–79.
14. Raymond Ruyer, Éléments de psycho-biologie (Presses universitaires de France, 1946), 74.
15. Ibid., 82.
16. On the emergence of molecular biology, see Lily E. Kay, *The Molecular Vision of Life: Caltech, the Rockefeller Foundation, and the Rise of the New Biology* (Oxford: Oxford University Press, 1996).