



# Modes of Bonding and Morphogenesis. Deleuze, Ruyer, and the Rearticulation of Life and Nonlife

Francesco Pugliaro<sup>1</sup> 

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## Abstract

This paper takes up some threads of Deleuze's and Ruyer's engagement with biology. I begin by laying out the main features of Deleuze's scheme of morphogenesis, through the lens of his references to embryology. I take Deleuze's interest in embryology to be guided by the effort to define bodies solely by form-generating factors which are immanent to them. His concept of virtuality, which indicates the creative component of reality, the open field of connections defining a body's capacities for transformation and interaction, plays a key role in this regard. I then consider two implications: (1) The insistence on morphogenesis displaces the question of life from given biological entities, which preserve themselves and act through regulated cycles, to the myriad of activities that compose and modify them; (2) It also rearticulates the distinction between the living and the nonliving, in that it separates the question of life from that of its emergence from a given material arrangement. In the second part I examine these points with greater reference to Ruyer. After introducing Ruyer's concepts of functioning and formation, I focus on his account of the continuity between biological and physicochemical forms, following some of his work on the microbiology and ethology of the time. The real difference is not between the living and the nonliving, but between two modes of bonding and composition variously operating on all scales: morphogenetic and statistical. I conclude by assessing the significance of this claim with respect to the traditional distinction between vitalism and mechanism.

**Keywords** Deleuze · Ruyer · Morphogenesis · Life and nonlife · Vitalism · Binding activity

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✉ Francesco Pugliaro  
francesco.pugliaro@kuleuven.be

<sup>1</sup> Higher Institute of Philosophy, KU Leuven, Leuven, Belgium

## Introduction

I would like to take up some threads of Gilles Deleuze's engagement with biology, as an example of a precise relationship between philosophy and the sciences. Deleuze mobilises a great deal of scientific practices in his work, often at a puzzling speed and with a high degree of compression. The speed increases in his collaboration with Félix Guattari. The effort of this article is to try to decompress certain moments of this story, and to do it through the lens of another author, Raymond Ruyer, with whom Deleuze maintained a modest but productive relationship in his work.<sup>1</sup> I believe that the perspective provided by Ruyer enables us to intensify a dimension of Deleuze's practice which is sometimes dissimulated by his commentators, despite its importance in all of his works, namely, the need to situate the discourse of philosophy on the terrains of scientific research. Ruyer has theorised this need in terms of a "philosophy-science" or a "philosophy united with science" (Ruyer 1957a, 2007: 12–4).<sup>2</sup> It is the idea of a philosophy which sees itself as something quite different from an epistemology or a philosophy of science, which seeks to install itself within scientific states of affairs and not to clarify them or to retrace their conditions of objectivity. What we find in significant portions of Ruyer's and Deleuze's works is the progressive deployment of a speculative or metaphysical plane where problems are posed on the basis of local questions, such as the development of an organism, the forms of aphasia, the territorial behaviour of birds, or the wasp-orchid symbiosis. Questions which are laboriously explored and arranged into "lines of continuity" (Ruyer 2016: 145; cf. Deleuze 2007: 179), and then made to converge on specific targets. This is the approach taken by Ruyer in *The Genesis of Living Forms* (1958),<sup>3</sup> where phenomena as *a priori* disparate as an embryonic formation, the articulation of a sentence, and the construction of a bird's nest start to function as so many clues into the nature of morphogenesis, and into the mode of being of the virtual and semantic themes which are at work in any formative activity, inherent in the movement by which things make themselves. An approach to philosophy which does not exclude, and indeed requires, a careful work of transformation of the results of scientific research, by which even the simplest biological observation can begin to function as a "metaphysical vision"<sup>4</sup> and encroach on other things, setting up "a vast interlinking of lines, planes, and relations" (Deleuze 1998: 47). All of Ruyer's and Deleuze's works are animated by this type of metaphysical attention: an attention for

<sup>1</sup> Four important moments of Deleuze's appropriation of Ruyer can be found in: (a) *Difference and Repetition*, where Ruyer appears as an important figure in the gestation of Deleuze's concept of virtuality (see also Deleuze 2004: 101); (b) in the distinction between 'molar' and 'molecular multiplicities' in *Capitalism and Schizophrenia* (Ruyer's thought haunts in particular the first two sections of the *Introduction to Schizoanalysis* and the 'plateau' *Of the Refrain*); (c) in the double critique against mechanism and dynamism in *The Fold*, through the establishment of the monadological lineage Leibniz-Whitehead-Ruyer(-Deleuze); (d) in the deployment of Ruyer's concepts of 'survey' [*survol*] and 'absolute surface' in *What is Philosophy?*, in order to account for the consistency of concepts and of the brain as creator of concepts. On the Ruyerian sources of Deleuze's thought, see Bogue (2005).

<sup>2</sup> All quotes from Ruyer, unless otherwise stated, are my translations.

<sup>3</sup> Ruyer likens this speculative approach to that of a "criminal investigation" (2020: 157).

<sup>4</sup> I'm borrowing the term from Bergson, cited in Chevalier (1959: 236). See During (2015: 59ff).

the connection of things, for the various ways by which things hold together, without ceasing to differ from one another. It is “necessary to return to the interior of scientific states of affairs or bodies in the process of being constituted, in order to penetrate into consistency”, Deleuze and Guattari write (1994: 140), that is to say, in order to determine how things *enter into coherence with one another*. In Ruyer’s words, the first task of philosophy is to “transform scientific observations into a knowledge of bonds [*liaisons*]” (2016: 224).<sup>5</sup>

One of the things that emerge most clearly through Deleuze’s and Ruyer’s engagement with biology is a precise work on the concept of life, which reformulates the categories of the vitalist tradition. They attempt in particular to deactivate one of the main devices of ‘traditional’ vitalisms, namely, the institution of a difference in kind between living and nonliving beings, constructed on the reference to a uniquely vital principle, property, or force which is characteristic of organic forms and absent in inorganic processes.<sup>6</sup> We could say that Ruyer’s and Deleuze’s ‘fieldwork’ in the life sciences of the time, and particularly in embryology, microbiology, evolutionary theory, and ethology, allows them to remove the phenomenon of life from the isolation in which traditional philosophies of life had placed it, by stressing its continuity with other formations, beyond the domain of the organic. The underlying challenge is to articulate an understanding of the earth such that the development of life does not appear “to be a miracle, or the expression of some intelligent design” (Stengers, 2007: 11). We will see that their project takes on the form of a vitalism of a different kind, based on a principle *external* to the given individuality of organic forms.<sup>7</sup> A “nonorganic” principle, as Deleuze and Guattari put it (1987: 411, 499, 503, 507), which crosses physical, biological, and psychosocial registers.

In order to clarify this idea, I will first revisit some passages of Deleuze’s *Difference and Repetition* (1968), through the lens of his references to embryology. I take Deleuze’s interest in embryology to be guided by the effort to define bodies solely by form-generating factors which are immanent to them, avoiding all forms of essentialist or typological thinking. His concept of virtuality, which indicates the creative component of reality, the open field of connections defining a body’s capacities for transformation and interaction, plays a fundamental role in this regard. I will then turn to Ruyer’s account of the continuity between biological and physicochemical formations, following some lines of his work on the microbiology and ethology of

<sup>5</sup> These considerations imply a precise renewal of metaphysics, which combines its traditional vocation for universality with a rigorously a-systematic method, and which substitutes the empiricist genre of the ‘inquiry’ to that of the ‘dissertation’. Élie During has spoken in this sense of a metaphysics that “attains the global through a process of local interconnection [*raccordement*]” (2015: 63; cf. 50, 58), always starting from singular problems or situations. Central to this idea of a ‘local metaphysics’ is the question of bonds or connections, both understood as a methodological principle – the function of concepts being to provide new connections, to trace continuities among heterogeneous things (cf. Deleuze 1995: 146–7) – and as a contention on the nature of reality, the internal consistency and coexistence of things being the result of their activities of self-formation and co-construction (cf. Ruyer 2016: ch. 10). For a contemporary approach to the question of connections, see Nef (2017).

<sup>6</sup> On the varieties of vitalism, see Wolfe (2011, 2021).

<sup>7</sup> Posteraro (2023) has identified a similar idea in Bergson’s reworking of vitalism. Deleuze’s indebtedness to Bergson is well known and has served as a key reference point in much of the scholarship on his ‘biophilosophy’ (e.g., Ansell Pearson, 1999; Grosz, 2007; Piatti, 2017).

the time. What emerges at the intersection of Deleuze's and Ruyer's projects is the necessity to subtract the concept of life from any question of essence or origin, interested in circumscribing the living being as a specific reality or domain of existence, characterised by distinctive properties and produced by unique causes.<sup>8</sup> Strange as it may seem, the versions of vitalism elaborated by Deleuze and Ruyer are rooted in a precise *attenuation of the specificity of organic life*, which grants a new status to the typically antivitalist gesture of posing, between the living and the nonliving, only differences of degree. The specificity of the organic must be articulated, in other words, in the language of *modes*: modes of bonding and morphogenesis, modes of capture and functional consolidation – a whole variety of actions operating on different registers and scales, of which the familiar categories of matter, life, mind, nature, and society are only particular articulations. In light of this, the traditional opposition between mechanist and vitalist philosophies, and the various caricatures of their relationship with the sciences ('rigorous' and 'progressive' in the former case, 'vague' and 'regressive' in the latter), prove of little help in understanding Deleuze's and Ruyer's gestures, as I will briefly show in the conclusions.

## The Intensification of Embryology

Deleuze's and Ruyer's elaboration of a form of 'inorganic vitalism', as some of Deleuze's commentators have called it (Colebrook, 2010), could be said to respond to the same problem, namely, to the search for what Ruyer called a "line of continuity" of beings (1946: 1), or the attempt to think reality transversally, beyond constituted boundaries and domains. In some moments of methodological reflection, both authors have claimed that their method consisted in searching for continuities among apparently discontinuous domains, without worrying about *a priori* classifications and hierarchies, and conversely, in retracing the discontinuities covered by apparent or false continuums (cf. Rosanvallon, 2021: 64; Ruyer, 2007; 2016: 162, 249; Deleuze 1995: 145-7, 156-9; 2007: 177-9). The concepts of 'matter' and 'life' could be seen as prominent examples of apparent continuums, which mix together and ultimately conceal different types of beings and activities. It remains to be seen how Ruyer and Deleuze reshape these ideas and what other types of articulations they produce.

A first moment of this story can be found in *Difference and Repetition*, where the concept of life undergoes a shift or change of scale which displaces the question of its nature and limits. Deleuze frames it as a passage from the extensive to the intensive, or from given biological forms to the morphogenetic activities that compose them. This fits with the overall project of the book, namely, the articulation of a 'philosophy of difference' in which individuals are seen as produced by processes of individuation beginning in a purely differential field. The idea, put otherwise, is that beneath any one state of a system (physical or biological, for instance) there are formative activities that continually produce it, activities which cannot be explained in turn as sequences of states, but require a different logic, capable of capturing the passage

<sup>8</sup> For a similar displacement of the question of life, inspired by Whitehead, see Debaise (2023).

from one state to another as a becoming, as a formation, as the direct actualisation of a potential or a virtuality (cf. Protevi, 2013: 5; Deleuze 1994: 214). When going through the elements of this discussion in *Difference and Repetition*, it is clear that Deleuze is amplifying some important changes in modern biology, among which embryology occupies a central place.<sup>9</sup> Embryonic development provides, in fact, a clear example of the type of movement in which Deleuze is interested, and to which he will give a maximal extension in his work, namely, a movement which “does not go from one actual term to another” in space and time, but “from the virtual to its actualisation” (251).

## A Scheme of Morphogenesis

The last two chapters of *Difference and Repetition* provide a brief overview of modern embryology, starting with Karl Ernst von Baer (1792–1876), one of the major participants in the 19th -century debate over the nature of organic specificity. Von Baer argued that organic development is essentially a process of individuation, which proceeds from more general to increasingly differentiated and specialised forms (cf. Gould, 1977: 55–6). In vertebrate limb development, for example, the differences between human hands and bird wings emerge only later, as all determinations of genus and species. At first human and bird embryos possess only a series of homologous traits which identify them *in general* as ‘vertebrates’, one of the four highest “types” of the animal kingdom, according to von Baer (cf. Gould, 1977: 55). The same principle of increasing differentiation holds in the order of spatial organisation: a limb bud is determined as a foot – as ‘foot’ *in general*, we might say – before it is determined as ‘right’ or ‘left foot’ (Ruyer 2016: 50; Deleuze 1994: 215). Now, Deleuze takes this as evidence that the processes of embryonic life do not operate within the limits of genera and species; in fact, they precede these classifications, in that they produce the properties that will allow biologists to compare organisms and classify them. To be more precise, Deleuze argues that embryonic processes do not operate within the limits of *any* taxonomic unit, no matter how high (genus, family, order, etc.). The problem lies in the very framework of typological thinking, “that style of thought in which individuation is achieved through the *creation of classifications and of formal criteria for membership in those classifications*” (DeLanda 2013: 32). As he puts it, “Individuation does not presuppose any differentiation; it gives rise to it” (Deleuze 1994: 247). The point is that any comparable difference among individuals, which can be classed into taxonomic units, is underwritten by a series of embryogenetic events which continually make and remake it according to a more fundamental field of relations or a “complex theme” – as Deleuze sometimes calls it, borrowing the term from Ruyer (cf. 183, 186, 189, 216), which is *virtual* in nature and admits a variety of actualisations.

This implies, however, a critique of von Baer’s concept of type, in that it tends to misapprehend the relation between generality and individuation. Here is Deleuze: “Baer concludes that epigenesis proceeds (...) from the most general types to generic

<sup>9</sup> Roffe (2019) has shed light on the role played by Ruyer in Deleuze’s use of embryology, as well as in the particular reading of Darwin put forth in *Difference and Repetition*.

and specific determinations. However, this high level of generality has nothing to do with an abstract taxonomic concept” – taxonomic concepts derive from successive comparisons among the products of embryogenesis – but is “*lived* by the embryo” in its field of individuation (249). Earlier in the book, Deleuze makes this point by invoking the work of one of von Baer’s students, Louis Vialleton (1859–1929):

[T]he highest generalities put forward by Baer are generalities only for an adult observer who contemplates them from without. In themselves, they are lived by the individual embryo in its field of individuation. Furthermore – as Vialleton (...) points out – they can only be lived (...) by the individual-embryo: there are ‘things’ that only an embryo can do, movements that it alone can undertake or even withstand (for example, the anterior member of the tortoise undergoes a relative displacement of 180 degrees, while the neck involves the forward slippage of a variable number of proto-vertebrae). The destiny and achievement of the embryo is to live the unlivable, to sustain forced movements of a scope which would break any skeleton or tear any ligaments. (214–5)

In other words, between the early stages of embryonic life and the life of adult organisms there is a “difference in kind” and not simply a “difference in generality” (215). The foldings and drifts that the embryo undergoes in the course of its development do not resemble the functions and specialised structures of developed organisms; in fact, they would break them, meaning the death of any fully formed individual. What we thus find beneath organic parts and qualities, “beneath the morphological, histological, anatomical, [and] physiological” characteristics of organisms, are not more general states, but systems of bonds and dynamisms of a different kind, whose activity implies, according to Deleuze, a “creation” (215). This point requires further clarification. I mentioned in the beginning that Deleuze’s treatment of living processes calls for the adoption of an intensive register. Indeed, as he writes, the processes of embryonic life cannot be fully accounted for in terms of displacements along paths in *extension*, decomposable into equal parts and defined by fixed relations of distance between points (237–8, 244–54). They are rather defined by *intensive* quantities, notably by changes in their relative speeds, as well as by differences in pressure and chemical concentration driving various transformations such as cellular foldings and migrations (214–8). Unlike extensive quantities, such length and mass, intensive quantities are marked by critical thresholds, at which a particular transformation takes place modifying the prior form of the system. The modalities of these transformations vary from system to system, but what is important to stress here is that changes in intensive quantities do not simply track, but *generate* transformations (cf. Mader, 2017: 267). They are “individuating differences”, as Deleuze calls them (1994: 247), effectively producing the extended space of the organism and of its complex structures.

In a further decisive step, Deleuze refers to these processes as determining waves of “actualisations” (214), formations, that is, which do not proceed through the simple accumulation of local actions, as in the case of certain geological processes, where the circulation of fluids and the successive deposition of sediment leads to the formation of mountain folds (a phenomenon which is sometimes referred to, perhaps

deceivingly, as ‘mountain morphogenesis’). The character ‘left foot’ does not come to complete the character ‘foot’ piece by piece, any more than a change in the intensive environment of an embryo can be said to hold in itself the key to limb formation, for it is often due to very ordinary factors, such as a difference in pressure or in the concentration of substances like steroid hormones, which yield different forms in other contexts. Rather, Deleuze argues, intensity differences are morphogenetic *only insofar as they set off the actualisation of virtualities* (Deleuze 1994: 216, 245–6, 251). What Deleuze is suggesting here is that the formative processes in which living beings are involved cannot be fully grasped through ordinary spatiotemporal schemes, however finessed by thresholds of intensity, in that they present a *transversal* coherence which “dominates” (216) the space and time of their successive states. This is what he calls a “virtual Idea”: a complex of “differential relations” and “singularities” (critical points marking system thresholds, which determine variations among these relations) which governs the visible structural transformations of a system (cf. 163–5, 216, 252–3; on ‘singularities’, see also Deleuze 1990: 52). Behind this there is a precise redefinition of the potential/actual scheme, which draws from conceptual innovations by Spinoza, Bergson, Ruyer, and Simondon.<sup>10</sup> Already at the chemical scale, the action space available to each thing is larger than what actually takes place at any given moment in any one system of interactions: certain connections are facilitated while others are not, or are effectively prevented. This is evident in embryonic formation, where cells are progressively restricted in their morphogenetic potential and become committed to specific pathways of development. A tissue sample from the brain-forming region of an amphibian embryo *could* form gills, if transplanted early into another location. After a certain moment, however, it can no longer do that: intersecting chemical signals trigger the differentiation of specific cell types, facilitating certain developments while suppressing others (see Barresi & Gilbert, 2020: ch. 11, 13). On the basis of this, Deleuze argues, biologists have tended to characterise formation in strictly negative terms, as *limitation* of power (Deleuze 1994: 212; Ruyer 2020: 11–3). Powers or potentials would be analogous in this sense to logical possibilities and life to a sort of ‘filtering’ mechanism, by which certain possibilities are thwarted while others come into existence. Deleuze’s proposition consists in characterising formation outside the exclusive framework of limitation, in that *it is entirely a product of external observation*: the idea that the formation of an organ is preceded by its own specific possibility, and in fact by a whole set of possibilities, only some of which are realised over time, belongs solely to the perspective of the biologist, who takes the fully formed organ as a given (Deleuze 1994: 214; Ruyer 2020: 12). Building on this point, both Deleuze and Ruyer like referring to a brilliant phrase by the embryologist Albert Dalcq, according to which “nothing is *a priori* caudal” in the formation of an animal, that is, *a priori* arranged according to specific axes or patterns (cephalic/caudal, dorsal/ventral, left/right) (Deleuze 1994: 251; Ruyer, 1946: 90). What takes place at any moment in a domain of morphogenesis never resembles an already conceptualised possibility, but results from creative and adaptive actions unfolding at different speeds and enlisting a variety of

<sup>10</sup> Among Ruyer’s works, Deleuze refers at this stage to *Elements of Psychobiology* (1946), *The Genesis of Living Forms* (1958), and to his 1956 article on ‘The Axiological Relief and the Feeling of Depth’.



mechanisms. As Ruyer notes, “the positive facet of determination [i.e., of the process by which cells become committed to specific pathways of development] appears through the creation of a *more complex* rather than a more primitive form” (2020: 12). A flattened plate of cells folds up and seals along most of its length to form a tube, which then becomes the complex structures of the brain and the spinal cord. Morphogenesis is an increase in detail, a production of novelty and difference (on all these points, see also Ruyer, 1946: ch. 3).

It is precisely in order to avoid “the identity and the resemblance of the possible, which inspire only a pseudo-movement, the false movement of realisation” (Deleuze 1994: 212), that Deleuze proposes ascribing to potentiality the new modal status of ‘virtuality’ (cf. Smith, 2012: 252-3). The possible/real relation, with its logic of resemblance and limitation, makes embryonic life unintelligible, as well as needlessly dull. As he explains with Guattari in *A Thousand Plateaus* (1980), the term ‘virtual’ should not be understood in opposition to ‘real’, as it does not describe predelineated possibilities simply awaiting realisation; rather, it indicates “*the reality of the creative*, of the continuous placing-in-variation of variables”, [which] is in opposition only to the actual determination of their constant relations” (Deleuze & Guattari, 1987: 99; trans. mod., emphasis added; cf. Deleuze 1994: 208-9). In other words, virtuality is the active dimension of a being’s self-formation, the open field of connections defining its powers or capacities to become, which may be actualised (and further enriched or diminished) in a variety of ways. This means abandoning the idea of a fully formed, self-identical potential preexisting its actualisation, or teleologically orienting it in its own image (cf. Protevi, 2013: 137). The characteristic of potentiality *qua* virtuality, in fact, is to be *differential* in nature, “to exist in such a way that it is actualized by being differentiated and is forced to differentiate itself (...) in order to be actualized” (Deleuze, 1988a: 97). That is to say, a formative process (in the case of the embryo, a cellular folding, stretching, splitting, or migration) is not the realisation of a pregiven potential, in this case, the activation of a specific gene regulatory network, fully formed and simply awaiting activation; rather, it is the active differentiation of that potential, a particular way of expressing its relations and singularities – relations of reciprocal determination between elements, points of inflection and transformation – in actual processes and terms (cf. Deleuze 1994: 184-5, 206-7, 211-2). In being actualised, then, a virtual potential necessarily differentiates itself and in so doing it produces something new, just as a musical theme is necessarily performed by following a line of variation, or as an idea is expressed through distributions on an open semantic chain. The lack of resemblance between forms and their virtual conditions is further amplified by the fact that virtualities give rise to *processes*, not to things, so that the results of the processes actualising the same virtuality may be highly dissimilar from one another, just like a human hand, a bird wing, and a whale flipper which not only do not resemble one another, but bear no similarity to the virtual guiding their formation – the ‘tetrapod limb’, in this case, whose actualisation can take many divergent forms (cf. DeLanda 2013: 14; Deleuze 1994: 212, 245-6).<sup>11</sup>

<sup>11</sup> “The egg destroys the model of similitude” (Deleuze 1994: 251).



In short, Deleuze's effort consists in characterising potentiality without the detour via an external mind, "which throws its image back into the past, once it has been enacted", as Bergson already showed (2007: 81), and thus in granting it full reality, as a positive power belonging to embryonic tissues themselves and immediately manifested in their differentiation (Deleuze, 1988a: 103; Ruyer 2020: 12). Reality but not corporeality, however, in that virtualities never coincide with their local actualisations, despite being indissociable from them, existing only within them precisely like ideas in a speech, continually redeployed in accordance with the circumstances and modified in turn at each actualisation. As Ruyer puts it, potentiality is always "situational" (1966: 180), always tied to a field undergoing transformation: "There is no 'actual' being than in the process of actualising itself. (...) In this sense, 'potentiality' is not opposed to 'actuality'. Potency is not a non-being that precedes action; it coincides with action" (171). In this regard, the virtual of an organism, with its intersecting series of genetic and epigenetic elements, could be seen as a sort of "distributed developmental guidance system", for it coordinates processes that are capable of changing the conditions that guide those very processes' next steps, by creating new connections which will express, in turn, new potentials (Protevi, 2013: 197, 210). We will come back to the nature of virtuality in the second part of this article, in reference to Ruyer. First, we need to look at some of the implications of these ideas.

### "A Transformation Present to Itself"

What Deleuze is stressing is that an adequate thought of embryogenesis is one that takes the point of view of the embryo itself, one that gives its dynamisms their own *ratio* and significance, without resolving them into an abstract typology that is only significant for an adult observer (cf. Roffe, 2019: 46). The potentials of the embryo must be understood within their field of actualisation, "not as belated, but as in some sense in the egg" (Deleuze 1994: 250).<sup>12</sup> Behind this there is a more general thesis: the nature of a being can only be glimpsed during its morphogenesis, before a final form is produced, that is, before its intensive variations are cancelled and the virtuals guiding its formation are blocked or concealed under the forms they create (cf. DeLanda, 2000: 36). Much of Deleuze's confrontation with the sciences is aimed precisely at shifting their emphasis from the initial or final state of a transformation to the transformation itself, to determinate bodies or systems of interactions as the events of their own coherence, of their own articulation (cf. Deleuze 1994: 20, 222–34). Recall his remarks on von Baer: what the essentialist or typological thinker sees as 'general types' of development, determined by tabulating differences and similarities among formed organisms, must be regressed from movements and potentials which are "lived by the embryo" (Deleuze 1994: 249) in the course of its formation. Before turning to Ruyer, I would like to emphasise Deleuze's choice of words in this last quotation, in that it points us to one of his most interesting gestures in this regard.

<sup>12</sup> In fact, Deleuze's brief overview of modern embryology, from von Baer to Dalcq, highlights the efforts made by embryologists to abandon static classifications and situate their analysis from the point of view of morphogenesis itself. One could add to his list, as Manuel DeLanda does in *Intensive Science and Virtual Philosophy* (2013: 71, 89), the perspective provided by more recent nonlinear, nonequilibrium approaches to embryology, notably by the work of Brian Goodwin.

In order to effect this change of perspective, he introduces the concept of the “lived experience of the embryo” (215) – an experience which does not resemble that of an adult organism, such as an embryologist, for example, intent on studying embryonic development and deploying to this end a variety of strategies and actions. The experience of the embryo is the process of embryogenesis itself, its own movement of individuation. Its data are not percepts and theories, as for the embryologist, but chemical signals, temperature gradients and other types of intensive differences, whose integration progressively forms a new being. We should consider the terms ‘data’ and ‘signals’ for a moment, for they seem to apply in the strict sense only to beings capable of perception, which clearly embryonic tissues are not. A hormone exercising a chemical action on a tissue that will become a retina is not ‘perceived’, contrary to other biological signals which require fully formed sensory organs, such as a bird’s mating call or resplendent tail feathers, but perhaps the difference is not essential. Ruyer has particularly insisted on this point: signal stimuli, whether they are chemical or perceptual, and in the diversity of their modes of action, are always tied to a *transformation* in the respondent – whether this is human, animal, or an organic tissue – which renders it capable of establishing new bonds. Whether they enlist or not sensory organs and nerve transmission, in other words, signal stimuli function less as release mechanisms for specific formative or behavioural protocols than as “activators of powers”,<sup>13</sup> as “invokers [*évocateurs*]” of novel developments, they are addressed to and actualise certain “morphogenetic competences” (Ruyer 2020: ch. 5–7). Placing embryology and ethology on a continuum of formations and binding activities is one of the main gestures of Ruyer’s philosophy (see 1953b, 2020, 2016). The idea is to understand behaviours and embryogenetic formations as processes by which either organs or regions in the developing embryo are captured by *themes* of activity, which are variously combined, enriched, and repurposed through successive actualisations (cf. Posteraro, [forthcoming](#)). Ruyer states it most concisely in his 1959 essay on Bergson: “The body of the bird, brain included, is made precisely like the nest” (2019: 138): the two processes are formations or binding activities occurring in different but continuous domains. At the limit, we could say that a bird that constructs a nest is an embryo that has not finished its growth, but continues it on new social and neural scales. Particularly relevant for the present discussion, this gesture produces a shift in the apprehension of life, in that it releases sense and potentials from individual organisms and their sets of meaningful relations with the world, referring them to the entire system of activities that compose them, chemical, cellular, microbial, embryonic, psychic, social, continually making bodies and ecological interactions of all sorts.<sup>14</sup>

At this point we can see what is at stake in Deleuze’s gesture, why he refers to the processes underwriting the structures and functions of constituted organisms, sensory systems included, as the ‘experience’ of the embryo, with its productions of differen-

<sup>13</sup> I’m borrowing the expression from Thibault De Meyer, cited in Despret (2021). Despret’s book offers an engaging development of this perspective in ethology.

<sup>14</sup> At stake is the very concept of biological individuality. Much has been written in recent years on the concept of organism that emerges from advances in the molecular methods for studying ecological interactions, notably at the microbial level (see for example Sapp, 2016).

tiated forms, its levels or thresholds of sensibility and various ways of being affected, both empowering and deadly.<sup>15</sup> What he ultimately extracts from his brief foray into embryology is a particular concept of subjectivity, released from the exclusive delimitation to mental domains and extended to every aspect of reality, wherever true formations occur. It is the idea of a subject which is never given once and for all, as the condition or the product of its movements, but which is continually made through them as they unfold. *A subject whose being coincides with the process by which it acquires consistency.*<sup>16</sup> Perhaps we could say that this is precisely what captivates his interest in embryology: embryology stages in a compelling way a type of activity which does not presuppose a subject, but is *itself* a subject, engaged in a continuous process of self-formation and deformation (cf. 220; Deleuze & Guattari, 1987: 238; Ruyer 2016: 86). The study of embryogenesis forces us to come to terms, as Ruyer puts it, with “the fact of a transformation present to itself” (2020: 142), capable of overseeing itself, so to say, without ‘taking a step back’, without requiring a supplementary dimension from which to evaluate the effects of its action. As we saw in a previous passage, Deleuze tends to qualify this activity negatively, in terms of movements that can only be experienced under conditions of ‘unlivability’, sustainable only by an unformed subject, unrealised, ‘sketched’ (Deleuze 1994: 214–5). It is clear, however, that these negations do not point to a lack or defect with respect to the fully formed organism, but rather express the conditions of an activity that never ceases to occur (cf. Ronchi, 2019: 169), all the more vital for always occurring at the limit of constituted forms. To say that the embryonic subject is unformed is to say that it never ceases to form itself: the lack appears only from the perspective of the being already become, of the developed organism as the product of embryogenesis.

At least two conclusions should be drawn from this. First, Deleuze’s intensification of embryology has the effect of displacing the question of life from the proper functioning of organisms, which preserve themselves and act through regulated habits and cycles, to the formative activities that compose and modify them. The defining mark of life passes from the constituted body to the body in the making, prior to organismic determination, that is, prior to the consolidation of its elements within a functional, self-regulating whole. The concepts of ‘body without organs’ and ‘nonorganic life’ put forth by Deleuze and Guattari in the 1960s and 1970s serve as further explorations of this idea. As much as Deleuze’s reference to the life of the embryo, “caught up in the field of its individuation” (1994: 250), Deleuze and Guattari’s concept of the body without organs does not describe a regression to an earlier

<sup>15</sup> From this viewpoint, we can see the continuity between embryology and Deleuze’s definition of ethology: “Ethology is first of all the study of the relations of speed and slowness, of the capacities for affecting and being affected that characterise each thing” (Deleuze, 1988b: 125), with respect to which structures and functions are always derived. The concepts of ‘speed’ and ‘affect’ occur systematically in Deleuze’s work, tracing a broad series of continuities. We could say that for each thing Deleuze seeks to distinguish its *speeds*, that is, the relations of movement and rest that compose and modify it, and its *affects* or capacities to become (cf. Deleuze & Guattari, 1987: 253–65; DeLanda 2013: 115–6). Embryology and ethology could be portrayed in this view as studies of different varieties of becomings.

<sup>16</sup> A ‘larval’ subject, to use the language of *Difference and Repetition*: “Before the embryo as general support of qualities and parts there is the embryo as individual and patient subject of spatio-temporal dynamisms, the larval subject” (215). “There are indeed actors and subjects, but these are larvae” (219), whose substantiality lies entirely in their effects. See Protevi (2013: 155–96).

stage, and much less a tendency towards undifferentiated matter, but consists in an intensification of the body's activity of self-production. The body without organs is "the intensive fact of the body" (2003: 45–6). Their references to the figure of the 'egg' in *Capitalism and Schizophrenia*, too often regarded as metaphorical, are quite clear in this regard:

The body without organs is the egg. But the egg is not regressive; on the contrary, it is perfectly contemporary, you always carry it with you as your own milieu of experimentation (...) The egg is the body without organs, (...) not 'before' the organism [but] adjacent to it and continually in the process of constructing itself. (Deleuze & Guattari, 1987: 164; cf. also 1983: 19, 84)

In short, embryonic life is not located in the chronological past of the organism, but continues to traverse it on multiple scales, as a morphogenetic power of invention which is always inherent in living tissues, never fully exhausted by organismic structuring and differentiation. From this perspective, Deleuze and Guattari's instructions for a careful practice of neutralisation of the effects of fixed patterns, capable of opening one's own body to new connections and becomings, could be seen as tools for the continuation of embryogenesis on the social, affective, and intellectual level.<sup>17</sup>

Second conclusion: this shift of attention in the apprehension of life, from given biological forms to the myriad of activities that compose them, has the effect of extending the concept of life beyond the domain of biological function and organisation. The concept of life is no longer tied to the idea of something emerging from a certain order or arrangement of matter, one allowing, for instance, the forms thus arranged to perform functions of adaptation and utility. Life is not the result of a particular arrangement, but the active assembly of the arrangement itself and its continuous placing in variation. It is for this reason that embryogenesis plays such an important role in *Difference and Repetition*, and reappears in key moments of Deleuze's work. The embryo (or the egg) is much more than an example for him: it provides a *scheme* of the advent of new beings, or any novelty-generating process (cf. Deleuze 1994: 251). Its intensive movements serve to create concepts of 'engendering' and 'morphogenesis' which can be carefully transposed into a variety of domains. Deleuze thus rejoins one of Ruyer's core propositions, namely, that there is no point of emergence of life, no absolute break or difference in kind between the organic and the inorganic. The important difference passes elsewhere.

<sup>17</sup> The concept of body without organs is linked to a practice of neutralisation of the structures blocking psychic life, aesthetic perception, and philosophical thought. An interesting parallel might be drawn with one of Ruyer's later works, *L'Art d'être toujours content* (1978), where he frames the exercise of joy – understood as a practice for 'living vertically', for escaping pre-given functions and paths by continually placing them in variation – as a continuation of embryogenesis in one's individual and collective life. On the body without organs, see Montebello (2008); Protevi (2018); Smith (2018).

## The Principles of Formative Activity

For Ruyer as for Deleuze, the practice of philosophy is closely linked to a “logic of multiplicities” (Deleuze 1995: 147), which distinguishes among the various modes of relation and association by which things hold together. There is one distinction in particular at the center of Ruyer’s thought, namely, a distinction between two types of bonds or liaisons. On the one hand, *local bonds*, operating step by step within a system, in both a spatial and a temporal sense, according to relations of proximity or states of equilibrium. On the other hand, *nonlocal bonds*, ubiquitous relations that continually traverse and mesh together the elements of a system, as an expression of the system’s own self-maintenance and sustained self-formation – of its ‘self-survey [*auto-survol*]’, in Ruyer’s terms.<sup>18</sup> Ruyer offers many examples of this distinction in his works, gathered from a variety of fields, but the important thing to stress here is that it does not separate organic from inorganic bodies, or life from nonlife, but it passes right through the middle of both, distinguishing at each scale what is self-consistent and morphogenetic from what is simply a statistical phenomenon or a massive structure, as well as their various modalities of mixture and interference.

## Functionings and Formations

These two modes of bonding, local and nonlocal, correspond to two different types of activity, which Ruyer calls respectively ‘functioning’ and ‘formation’, and which imply two different ways of being in space and time, two entirely different ways of taking place.<sup>19</sup> In *The Genesis of Living Forms*, Ruyer defines functioning as “the setting in motion of a predetermined structure given in space” (2020: 157). Indeed, ‘structure’ and ‘functioning’ should be taken as synonyms here. In mathematics as in biology, a structure can be defined as a closed set of possible functions or operations (xiv). A dog’s mode of digestion, for example, comes to the same thing as the structure of its digestive system ‘plus’ the structure of the nervous system that coordinates it, from the macroscopic to the subcellular level. By accounting for the spatial disposition and function of cell receptors and other structures, for instance, molecular biology can perfectly describe how a dog is capable of digesting or breathing. The formation of a dog from a single fertilised egg cell, however, poses quite a different problem, for any function – even the most stereotypical, even the most mechanical – was at one point the object of a formative process. And that process cannot be accounted for in turn in terms of functions and readymade structures (xiv–xv).<sup>20</sup> We are back to the problem of embryogenesis.<sup>21</sup> All the elements required for the proper functioning of organisms – self-regulating cycles and channels, mechanical and dynamic equilibria, and step-by-step bonding of all sorts – play a fundamental role in the preservation of life, but they only establish secondary, “horizontal” con-

<sup>18</sup> On the decisive concept of ‘self-survey’ or ‘absolute survey’, see Ruyer (2016: 90–123).

<sup>19</sup> See During (2020) for a more elaborate analysis of Ruyer’s concept of spacetime.

<sup>20</sup> A similar remark can be found in Jacob (1982: 44; cf. Marks, 2006: 92).

<sup>21</sup> See Vaillant (2017) for a more detailed portrayal of Ruyer’s engagement with embryology, in dialogue with more recent challenges in developmental biology.

nections, which follow the logic according to which structures function once they are formed (cf. Deleuze 1993: 103–4). As Ruyer puts it elsewhere, with a certain Nietzschean tone, a structure is always the “symptom of a much more fundamental system of binding forces” (1946: 5).

Formative activities therefore require a different logic, which Ruyer qualifies as “vertical” or “thematic”, in homology with other domains in which morphogeneses normally occur, namely, the domains of artistic and technical invention (2020: xv). A musical improvisation, for example, draws its coherence from a series of rhythmic and melodic themes which are not inscribed in any local movement or sequence, but are displaced in all of them, continually readjusted and recomposed. Here is Ruyer:

A dance, animal or human, is more than the succession of its states: it conforms to an enveloping, dominant theme which temporalises or spatialises itself in movements but does not lose itself in space and time, and which will eventually allow the ‘same’ dance to be repeated. (Ruyer, 1966: 92)

A purely functional or structural account of a dance would capture only its “shadow”, as he puts it, and not its real formation, which is located “in space and time only at the limit and to the extent that its enveloping theme is actualised from moment to moment and from place to place” (92). On Ruyer’s account, any genuine formation, or indeed any genuine activity – for true activity is indissociable from a type of morphogenesis, that is, from the transformation of the elements involved in it and the creation of new connections – is ‘thematic’ in this sense. It makes its coherence as it goes along, not on the basis of a predetermined plan or programme, encoded in its structure or impressed upon it from without, but in accordance with “potential themes” (99) – “forces”, as Ruyer defines them, *which coordinate the successive transformations of a system without “impos[ing] in general a determinate structural solution”* (179–80; emphasis added), operating like “ideas to be expressed” or “tasks” to be performed (220).<sup>22</sup> In Ruyer’s view, sciences like ethology and experimental embryology provide veritable inventories of thematic actions, in that they multiply inquiries into the ways in which formative themes are played out in response to shifting circumstances, tracking their ongoing displacements and recombinations. One can think of the ways in which sexual and parasitic behaviours in many animals actualise and redeploy elements of the same “themes of attack, combat, flight, as well as the offer of nourishment and infantile behaviours” (Ruyer, 2019: 142), or of “a fish’s swimming rhythm, where there is a thematic contamination of the rhythms of different fins, and even of respiration” (Ruyer 2020: 105), enlisting structures which are themselves derived from the coordination of cellular collectives in the course of development. These kinds of considerations establish a particular relation between a system’s coherence, its activity, and the virtuals that coordinate it, a relation of self-

<sup>22</sup> Ruyer develops the concept of ‘theme’ by working on various strands of psychology and ethology of the first half of the 20th century, notably the Würzburg school of psychology (Ach, Watt, Selz...), John H. Jackson’s studies on aphasia, the theories of instinct developed in the Dutch-German (Tinbergen, Lorenz, von Frisch, von Holst...) and North American traditions (Hull, Hebb, Richter, Lehman...), William McDougall’s ‘pluralistic psychology’, and Albert Burloud’s psychology of tendencies. On thematism and morphogenesis between Ruyer and Deleuze, see Tenti (2019).

production, as we have seen with reference to Deleuze. “The living being is at once the agent and the ‘material’ of its own action. It (...) forms itself directly in accordance with a theme”, or better, with a multiplicity of themes, variously dominating each other and seizing the living being from within, “without the theme first having to become an idea-image or a represented model” (175). Deleuze says it in his own way when he writes that “the organism is nothing if not the solution to a problem, as are each of its differentiated organs”, thus concluding that “the virtual possesses the reality of a task to be performed or a problem to be solved” (Deleuze 1994: 211, 212). An endogenous theme or problematic governs the behaviour of a system, as a demand for further actions which can give rise to many different forms, according to the peculiarities of the bodies that actualise it, to the distribution of their internal and external milieus, and whose transversality with respect to the dimensions of a system is precisely the mark of its *semantic* nature:

The problems of embryological formation are always essentially ‘vertical’, like the problems of aphasia. They manifest themselves through condensations, agglutinations, duplications, preservations, abnormal developmental arrests – in short, through a gruelling transition in space of non-spatial themes. (Ruyer 2020: 167)

Behind this there is a precise theory of invention, which traces a continuity between all *formative, nonfunctional activities* at all scales, physical, chemical, biological, psychic, social, intellectual, cosmological. We will further expand on Ruyer’s reasoning in the next section, but we can already sketch a general conclusion. Certain domains of reality, whether they are usually categorised as ‘human’ or ‘nonhuman’, ‘sentient’ or ‘nonsentient’, ‘mental’ or ‘material’, present characteristics that allow us to place them on a continuum of actions. A pianist “composes, fumbling, a melody that expresses a vague feeling that he is experiencing” (95). A bird builds a nest or repairs a damaged part of it (93–5). “From the vague and atmospheric impressions induced by the madeleine, Proust reconstructs the immense edifice of his recollections” (Ruyer 2016: 73). “Touched by the optical vesicle, the ectodermic tissue rapidly constructs a lens and a cornea from a simple thickening of the cephalic epiblast” (73).

### **Thematism and Continuities of Action**

Let us pick up the thread of this continuity from another point. In his working-through of biology, Ruyer often lingers on certain zones of transition between the living and the nonliving, notably in virology (Wendell Stanley had reshaped the field in the 1930s by succeeding in extracting a virus in the form of pure crystals, allowing the study of its characteristics), in molecular and cell biology (Frey-Wyssling, Haldane, Bernal...), and in what we could call ‘unicellular ethology’, or the study of the behaviour of unicellular organisms and their colonies, notably amoebae, bacteria, and algae (Thaxter, Jennings, Bonner...).<sup>23</sup> One of these figures is given particular

<sup>23</sup> The topic has already been given some attention by Meslet (2005) and Colonna (2013).



attention in *The Genesis of Living Forms*, namely, Albert Frey-Wyssling, a Swiss biologist who had done pioneering research in the 1930s on the micromorphology of plant cells. Thanks to the development of electron microscopes, he was able to show that the fine structures of cells – membranes, mitochondria, and all the other textbook ‘unities of life’ – do not arise from uncoordinated masses, as from a liquid where isolated molecules float randomly, but derive without hiatus from structures of a different type, macromolecular, but just as flexible and subsistent. This was his conclusion:

Whoever had expected to find special biological formative principles, alien to the inanimate world, in these invisible regions, is doomed by the results of research (...) to as great a disappointment as was one time suffered by the believers in mysterious life forces, which alone were deemed capable of building up organic compounds. The formative forces in protoplasm and its derivatives are no different from those operating within inanimate Nature. Frey-Wyssling (1953: 371)

In other words, at the molecular level the chemical properties of bonds are already indissociable from morphological properties (cf. Ruyer 2020: 30). A benzene molecule, which is composed of six carbon atoms joined in a hexagonal shape, with one hydrogen atom attached to each, “is not an amorphous matter that comes to be ‘informed’ by the shape of the hexagon, supervening like an Aristotelian form”, but is “this form itself”, this active bonding or formation, “which in turn derives from the modes of bonding of carbon and hydrogen” (31, trans. mod.). This led Frey-Wyssling to extend the principles of his discipline beyond the threshold of the organic: “The supreme axiom of cytology, namely, that all cells derive from their like, applies equally, though in a wider sense, to invisible, submicroscopic cytogenesis: *Structura omnis e structura*” – all structures, whether living or nonliving, stem from other structures (1953: 374).

Now Ruyer, much like Deleuze in his reading of embryology, stresses the intensive character of this conclusion. He does not invoke a *structural* continuity between organic and physicochemical forms, but a *formative* one, a continuity of action, of “morphogenetic behaviour” (Ruyer 2020: 164). In other words, the continuity between the living and the nonliving is not constructed on the permanence of a certain form or organisation, but on an affinity in their principles of actualisation. In chemistry as in biology, Ruyer argues, forms are essentially “virtual”, in that they depend on “forces of composition” (Ruyer 2020: 35). A chemical body, just like any other enduring body “insofar as it implies a *system* of interactions”, is never purely actual but consists in an ongoing actualisation of potentials which are “transversal to space [and time]” (Ruyer, 1948: 148). To return to the previous example, a benzene molecule is less a hexagonal structure than a typical process of ‘hexagonalisation’, which occurs when six carbon atoms form a system of identical bonds by delocalising one of their electrons in the unity of the system. As Ruyer writes, the successive moments of this process do not “mark the progress of a functioning” or the persistence of a structure in time, but are subordinated to “a certain prolonged rhythm” of

spatial and temporal actualisation (Ruyer 2016: 145, 149).<sup>24</sup> A molecule “makes its duration according to a rhythmic theme” (1959: 107), one that is certainly quite binding, for it leaves it scarcely any room for variation,<sup>25</sup> but nonetheless virtual, governing its continuous process of formation. Ruyer can thus contend that virtuality, in physicochemical as in biological processes, is fundamentally thematic: *every actual is traversed by virtuals or potentials which actualise themselves as themes or motifs of action*. As a result, morphology is first and foremost morphogenesis, in chemistry and in physics just as much as in biology, while functioning based on established patterns and connections is secondary and derived (cf. Ruyer 2020: 35–6).

There is therefore no need to invoke the intervention of a specifically ‘vital’ force into the chemical form of a molecular assemblage, different in kind from the physical forces on which it operates: “The morphogenetic forces that shape higher organisms are in perfect continuity with the forces discovered by microphysics” (Ruyer, 1957a: 9, cf. 2020: 44, 164), with the bonds ensuring the coherence of microphysics’ and chemistry’s domains of action. Ordinary physical forces, as they appear in classical physics and, more generally, in any set of step-by-step interactions within a ‘crowd’ (organic, physical, or social), are simply the statistical result of the accumulation of a large number of morphogenetic domains, whose activity presents the same characters as the formations dispersed across the organism (Ruyer 2016: 106–7, 202–9, 230–1, see the use made of Ruyer’s claims by Deleuze and Guattari 1983: 285–8). This is a fundamental point of arrival in Ruyer’s work, to which he repeatedly returns in his texts. The evident differences among these scales, among physicochemical, cellular, and organismic activities, should therefore be understood as *modes or variations of a single fundamental type of activity, active formation or morphogenesis*, that is to say, as different manners of generating coherence, of acquiring and producing consistency. The virtuals governing the formation of an organism are certainly different from those operating in the microphysical world, but the fact that both are distinct from the laws that coordinate the behaviour of structures and of statistical aggregates legitimates, in his view, the connection between microphysics and biology (cf. Colonna, 2017: 69).<sup>26</sup>

As regards the question of organic specificity, the consequence is clear: instead of positing the absence of inventive and coherent behaviour in the inorganic world, we need to determine when or at what conditions certain morphogenetic processes can be said to become organic. As this is too large a topic to discuss in detail here, I would like to draw attention to a single point: both Ruyer and Deleuze seem to individuate the difference between the organic and the inorganic (or rather, their difference-maker) in a specifically *technical* operation: it is a matter of determin-

<sup>24</sup> Ruyer takes up Bachelard’s analysis of the theory of chemical bonds drawn from wave mechanics, which breaks with structural conceptions of physicochemical entities (Bachelard, 1953: ch. 4–5). See in this regard Ruyer’s stimulating review of Bachelard’s *Le Matérialisme rationnel* (Ruyer, 1953a).

<sup>25</sup> The composition of a molecule can nonetheless be subject to significant variations, as shown especially by the case of viruses.

<sup>26</sup> The question then arises of distinguishing among different types of themes. In his work, and notably in *Neofinalism* (2016: 124–39), Ruyer traces for this purpose a whole cartography of the virtual.

ing what technique of bonding and organisation is constitutive of organic bodies.<sup>27</sup> It seems, indeed, that the formation of life is inextricably linked to the formation of machines (a machine being, in the classical sense, a technique based on established connections).

We can therefore specify our main conclusion. The principles exemplified by formative activities across various domains, organic and inorganic, do not define strict orders that would allow us to arrange them in superimposed levels or hierarchies, and to conclude, for instance, that life is essentially a product of chemical functioning; rather, they redistribute agency among these domains, making us attentive to the multitude of beings and activities that general concepts such as ‘matter’ and ‘life’ tend to conceal and to reduce to inconsistency.<sup>28</sup> Thus, while Frey-Wyssling tends to reject the opposition between the organic and the inorganic in the direction of a form of reductive materialism, thereby undermining the vitalist’s intuition of a difference in kind between matter and life, Ruyer welcomes this last conclusion by rejecting the distinction in the opposite direction, as the principle for a vitalism of a different kind, one that does not treat life as a force or a property that supervenes over physical masses, but as an inventive activity at work in all genuine formations, along “morphogenetic lines” (Ruyer 2020: 41) that connect the living being to the cell, to the virus, to molecular assemblages, all the way down (cf. Roffe, 2019: 51). “The mystery of life is nothing but (...) the mystery of all primary bonds, of all birth of true form in morphogenesis, whether chemical or biological” (Ruyer 2020: 39).<sup>29</sup>

Instances of continuity between organic and molecular morphogeneses are numerous, as studies in microbiology continue to show. An example is the striking thematic and behavioural coordination of the molecular structures involved in microbial motility (flagella, cilia, pseudopods), both individual and collective (cf. Colonna, 2013: 39). In *The Genesis of Living Forms*, Ruyer brings up this point by referring to the role played by contractile proteins in the movements of amoebae, as described in some works of the 1950s, drawing a parallel with human muscle contraction:

the movements of amoebae, which were thought to be a phenomenon of diffusion and surface tension, are more likely to be explained by the self-folding and unfolding of protein molecules in the amoeba. Like movement in protozoa more generally, moreover, this constitutes true behaviour. A continuity can therefore be observed here between chemical and biological behaviour. Incidentally, contractile proteins also play many other roles, notably in the movement of vibrating cilia and in muscular contraction in general – so much so

<sup>27</sup> *The Genesis of Living Forms* and *A Thousand Plateaus* provide extensive developments of this point.

<sup>28</sup> I’m transposing here an observation made by Debaise (2017: 138-9) on the effects of Whitehead’s concept of ‘actual entity’. Indeed, there is a similar device at work in Whitehead’s philosophy, linked to the articulation of a continuity of action among beings which cuts across given hierarchies and “diversities of function” (see the famous passage in Whitehead 1978: 18). A link could be made with contemporary discussions on biological agency, notably on the question whether we should speak of superimposed *levels* of agency, ordered in terms of hierarchy or priority, from the simplest bacteria to ecosystems, or whether “it is more fruitful”, as Di Paolo (2023) recently put it, to think of agency in terms of “kinds and scales”.

<sup>29</sup> On the cosmological implications of this idea, see Ruyer (1957b; 2016: 140 ff.).

that human movement derives, in quite a direct fashion, from the contractile properties of molecules. (2020: 42, trans. mod.)

The “patient work of micromorphologists” (33), such as biochemists and cell biologists, does not necessarily entail a form of reductionism, or the deduction of life from the movements of inert matter. It might in fact lead to an extension of thematic behaviour across heterogeneous domains, human and nonhuman, organic and inorganic, wherever true formations occur.<sup>30</sup> The behaviour of an amoeba improvising its own pseudopods for locomotion, through the direct projection of its cytoplasm, is no less a behaviour than human locomotion, which involves putting one leg in front of the other. If anything humans, unlike amoebae, rely on a whole system of readymade connections and articulations that do not need to be improvised case by case, according to which we can just ‘function’. Even in this case, however, mechanical functioning is subordinated to the morphogenetic behaviour of cellular networks in the brain, where a motor pattern is continually improvised, and, from a developmental point of view, to the morphogenetic behaviour of embryonic tissues, which gave rise to the brain and the skeleton in the course of development (143).<sup>31</sup> “If we disregard the superadded and amplifying mechanisms, a man grasps an object in exactly the same way that an amoeba closes in on its prey” (Ruyer, 1959: 109).

## Relocalising the Operation of Vitalism

The preceding remarks suggest a particular displacement of the question of life, as well as a relocalisation of the point of contention between vitalism and mechanism. I stated in the beginning that Deleuze and Ruyer seek to transpose the concept of life on an intensive register, by displacing it from the given unity of organic forms to the formative activities that compose and connect them. The question of life is indeed rooted by the two authors in a broader question of bonds, forces, and agencies which do not allow themselves to be attributed to given aggregates or substrates, in that they are always “in excess of functioning” (Ruyer 2020: 160), always cutting across and reshuffling constituted forms and distributions. *A Thousand Plateaus*, which is certainly Deleuze and Guattari’s most ambitious work, can be seen in this regard as an encyclopedic exploration of the binding activities traversing matter, life, nature, minds, and societies, and of their related logics (cf. Lapoujade 2017: 23), as a quest for relations of a different nature, relations productive of variations, operating on all scales “like so many little segmentations-in-progress” (Deleuze & Guattari, 1987: 195) capable of breaking the rigid segmentarity that encloses individuals within pre-determined spaces and domains (the concept of ‘line of flight’, a core component of

<sup>30</sup> This conclusion should be contrasted with later structuralist attempts (Thom, Petitot...) to reduce formative activity at all scales to an interplay of structures, now understood as controlled dynamical systems. Guattari has particularly countered this view (Guattari, 1995: 33–57; Sarti, 2023).

<sup>31</sup> “In psycho-social behaviour, the functioning of the body is subordinated to the immediate behaviour of the ‘projected body’, of the cortical *homunculus* that behaves in the manner of a unicellular organism or an amoebic colony” (Ruyer 2020: 6–7, cf. 171). On the brain and the embryo, see Ruyer (2016: 45–75).

the metaphysics of *A Thousand Plateaus*, responds precisely to the need for tracing escapes from rigid morphologies).

In this framework, the historical concerns of vitalism find themselves redistributed across the entire expanse of nature, within organic and inorganic formations alike. It is no longer a question of preserving the singularity of the living being in a world of purely quantitative, mechanical forces, of the bounded organism forging its difficult path through matter and making sense of its world. Between physical and organic forces there is only a “difference of mode” (Ruyer 2016: 208), only a *difference of mode of action*: organic life is, in other words, a particular instance of a type of activity – actualisation, nonlocal bonding, self-formation – which is “schematically common” (162) to all beings, effectively involved in all physical, biological, psychic, social, and intellectual operations.<sup>32</sup> In the most Ruyerian section of *Anti-Oedipus* (1972), entitled “The Molecular Unconscious”, Deleuze and Guattari speak of a “domain of nondifference between the microphysical and the biological”, the two modes of action operating with one and the same force, with one and the same productivity in each of their occurrences, in opposition to the “mass phenomena” that occur on both scales, which operate through statistical accumulation and aggregation (Deleuze and Guattari 1983: 286).<sup>33</sup> Here, Ruyer’s relocalisation of vitalism is linked to another gesture, triggered by Guattari a few years prior, which consisted in freeing the concept of ‘machine’ from the grips of mechanism, that is, from its reduction to a structure or a set of predetermined functions and connections (see Guattari 2015; Smith, 2018). Indeed, their focus on self-productions and morphogeneses of all kinds has the effect of driving both vitalist and mechanist arguments to the limit, carrying them “to an extreme point” where one “can no longer be opposed to the other” (Deleuze and Guattari 1983: 283). “The real difference”, Deleuze and Guattari argue, “is not between the living and the machine, vitalism and mechanism, but between two states of the machine which are also two states of the living” (285–6, trans. mod.). On the one hand, a state or regime of invention and self-formation, which pertains to both physicochemical activities and the morphogenetic forces that shape living beings, from their bodies to their psychosocial interactions; on the other hand, the unities that emerge (structural unities, organic and specific unities) when these activities enter into “statistical forms” (287), that is to say, when they are organised into relatively stable aggregates according to the global effects of their interactions. “There is interpenetration, direct communication between the molecular phenomena

<sup>32</sup> These considerations imply for both Deleuze and Ruyer, albeit with different emphasis, a critical appropriation of Bergson’s legacy. As Protevi (2013: 196) notes, “if we want to follow Deleuze all the way, we’ll have to go not only ‘beyond the turn’ in (human) experience, as Bergson puts it, but ‘beyond the turn’ of (living) experience, out into the ‘plane of consistency’ we find posited in *A Thousand Plateaus*”. See also Piatti (2021: 240–50). Much of Ruyer’s work is constructed precisely on the idea that recent advances in the sciences endow such a project with greater precision, opening the way for (a) the removal of ‘matter’ from the position of universal “ground floor” of the world (Ruyer 2016: 141), capable, if necessary, to reabsorb the levels allegedly constructed on it (organic, psychic, cultural); (b) the integration of all physical, biological, and anthropological differences within a coherent ‘plane of nature’, free from the phantom of naturalism. See Montebello (2015) for a broad discussion of these points.

<sup>33</sup> This section of *Anti-Oedipus* is based, in part, on a reelaboration of some passages of Ruyer’s *Genesis of Living Forms*. Acting as intercessor is the English novelist and amateur biologist Samuel Butler, who was himself a major influence on Ruyer.

and the singularities of the living being (...), there being as many living beings in the machine as there are machines in the living” (286), as many functionings in an organism and there are active formations in a collection of molecules. We should in other words be mindful of the ways in which mechanist and vitalist projects have tended to make this continuity unthinkable, either by “attempt[ing] to derive organisms from a secondary arrangement that supervenes over physical masses, conceived as primary” or by seeing them as “a singularity in the physical world, derived mysteriously from” it (Ruyer 2020: 41). From this perspective, indeed, mechanist efforts to explain the organism in terms of unities and laws borrowed from the order of macroscopic physics, and vitalist arguments invoking the global unity and equilibrium of biological individuals are only “two paths in the same statistical direction” (Deleuze and Guattari 1983: 286), two ways of apprehending beings and activities from the point of view of the configurations they form through step-by-step bonding and through the consolidation of their functions for those configurations, which imply a constraint on their capacities for action. Deleuze and Guattari’s much-discussed ‘assemblage theory’, which seeks precisely to examine the modalities of these consolidations, to determine how heterogeneous elements come to be bound together in enduring coordinations, can hardly be understood through the alternative lens of vitalism and mechanism (see in particular Posteraro, 2020).

This is, then, Deleuze’s and Ruyer’s wager, or at least the one that emerges at the intersection of their projects: *life is not a scale-specific phenomenon*. The problem of life should be posed on the basis of a broader problem, which is not limited to any particular system or domain of reality, but intersects them all: *the problem of coherence or consistency*: “How do things take on consistency? How do they cohere?” (Deleuze, 2007: 179). What types of activities compose and connect them? It is precisely their effort to think life insofar as it participates with all other things that makes Deleuze’s and Ruyer’s approaches fundamentally metaphysical. It is the idea that we should expand the dimensions of each phenomenon, and vary its scales, so as to put into perspective the way it constitutes itself and connects to other phenomena, beyond any *a priori* distinction between domains (cf. Debaise, 2004: 16, 19). Their insistence on putting coherence before (and beyond) the organism, moreover, implies a significant philosophical shift, for the body and its lived relations can no longer be conceived as the origin of senseful activity but, on the contrary, as one of its effects.

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