13

RESPONSES TO EVOLUTION: SPENCER'S EVOLUTIONISM, BERGSONISM, AND CONTEMPORARY BIOLOGY

Keith Ansell-Pearson, Paul-Antoine Miquel
and Michael Vaughan

Darwin's *On the Origin of Species* was published towards the end of 1859 and although its influence on the intellectual life of the second half of the nineteenth century was immense and dramatic, it alone did not generate the rise of interest in questions about evolution. As one commentator has noted, most nineteenth-century evolutionists were Lamarckians or Spencerians rather than Darwinians: Jean-Baptiste Lamarck (1744–1829) had published his theory of progressive evolution in *Philosophie zoologique* in 1809 and Herbert Spencer (1820–1903) had developed an evolutionary theory of mind and behavior in his *Principles of Psychology* of 1855.[1] It is often assumed that Spencer and Darwin adhere to the same theory of evolution but this is not the case; and it is Spencer who, at least for philosophers, was the major intellectual figure of the period. Some of philosophy's most original minds, such as Charles Sanders Peirce (1839–1914) and Henri Bergson (1859–1941), took note of the Darwinian revolution and the rise of philosophical evolutionism and sought to respond to them.[2] Bergson captures the mood well when he writes in his great text of 1907, *Creative Evolution*, that "the language of transformism forces itself now upon all philosophy, as the dogmatic affirmation of transformism forces itself upon science."[3] Let us note at the outset that Darwin's aim in the *Origin of Species* was not to promote the concept of evolution – the word only appears at the very end of the

1. L. Menand, *The Metaphysical Club* (London: HarperCollins, 2001), 121.
2. For insight into Peirce and evolution, see C. R. Hausman, *Charles S. Peirce's Evolutionary Philosophy* (Cambridge: Cambridge University Press, 1993).
3. H. Bergson, *Creative Evolution*, A. Mitchell (trans.) (Basingstoke: Palgrave-Macmillan, 2007), 17. Hereafter cited as CE followed by the page number.

book[4] – but rather to do away with the notion of supernatural intelligence, that is, the view that the universe is the result of an idea or plan. As one commentator has noted,[5] what is radical about Darwin's book is not its evolutionism but its materialism: species evolve according to processes that are entirely natural, chance-generated, and blind. Indeed, Darwin's choice of the word "selection" may be unfortunate since it suggests an intention at work in nature, while the process of evolution is a blind one: "The selection of favorable characteristics is therefore neither designed nor progressive. No intelligence, divine or otherwise, determines in advance the relative value of individual variations."[6] There is, then, no ideal type or essence of a species toward which adaptive changes are leading. In his *The Variation of Plants and Animals under Domestication* (1868), Darwin makes it clear that the process by which living things evolve can be explained without making use of any theory of design.

In this essay, we focus attention on Bergson's *Creative Evolution*, since this is without doubt the most important text on evolution by a continental philosopher. It contains an important critique of Spencer's evolutionism; it is intellectually ambitious and rich in showing how philosophy and science can reach a new rapport concerning questions of life; and it has inspired major developments in both post-war philosophy (notably the work of Gilles Deleuze) and recent biology (notably in applications of complexity theory and non-linear thermodynamics to the study of living systems).

HERBERT SPENCER AND EVOLUTIONISM

Spencer's ideas on evolution are primarily contained in his *First Principles* (1862) and his two-volume work, *The Principles of Biology* (1864, 1867). In the first work, he sets himself two main tasks: first, to come up with an adequate definition of the aims and scope of philosophy; and, secondly, to provide an adequate conception of evolution. Spencer accepts that philosophy has limits of knowledge and affirms the idea that philosophy is unable to formulate "Being" in

4. The idea of evolution is presented at the end of the *Origin of Species* in a way that permits one to speak of a kind of Darwinian sublime: "Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved" (*The Origin of Species* [Harmondsworth: Penguin, 1985], 459–60).
5. Menand, *The Metaphysical Club*, 121.
6. *Ibid.*, 122.

distinction from "Appearance." In short, philosophy is not an ontology.[7] But what is its character once these limits have been acknowledged? Spencer considers the rivalry between German and English philosophy in which "the English criticism" repudiates everything regarded as absolute knowledge. What they share, however, he notes, is a commitment to philosophy as the discipline that is concerned with systematized knowledge. What is needed is a useful contrast between philosophy and science. Spencer proposes that science "means merely the family of Sciences" and consists of "truths more or less separated"; by contrast philosophy stands for truths that have been integrated (FP 37). He writes:

> How, then, is Philosophy constituted? … So long as these truths are known only apart and regarded as independent, even the most general of them cannot without laxity of speech be called philosophical. But when, having been severally reduced to a mechanical axiom, a principle of molecular physics, and a law of social action, they are contemplated together as corollaries of some ultimate truth, then we rise to the kind of knowledge which constitutes Philosophy proper. (FP 37)

Philosophy's job is to "comprehend and consolidate the widest generalizations of Science" (FP 37). If science is partially unified knowledge, philosophy is completely unified knowledge. Knowledge begins with crude and isolated observations; it then seeks to establish propositions of a broad scope that are separate from particular cases; and finally, it culminates in the articulation of universal propositions. It is important to note that Spencer is placing the stress not simply on knowledge as a process but rather on philosophy being able to express definite pieces and truths of knowledge; that is, his concern is not with the validity of the act of knowing but with the actual product of knowledge, such as an ultimate proposition that "includes and consolidates all the results of experience" (FP 42). For example, philosophy shows that we always think in terms of "relations" and its elements, such as likenesses and differences. Our thought enjoys a status of "relativity" and is thus forever debarred from "knowing or conceiving Absolute Being" (FP 47).

In the case of "evolution" the concern is with specifying its most general laws, for example, showing that "in its primary aspect" it denotes a change "from a less coherent to a more coherent form consequent on the dissipation of motion and integration of matter." Spencer takes this to be a *universal process*, that is, one through which "sensible existences," both individually and as a whole, pass

7. H. Spencer, *First Principles* (London: Watts & Co., 1937), para. 36. Hereafter cited as FP followed by the paragraph number.

during the "ascending halves of their histories" (FP 115). He contends that this holds for both the earliest changes in the visible universe and the changes that can be traced in societies and the products of social life, including science itself. Spencer is thus identifying a law of development that can be applied to all things that undergo evolution, be it a solar system, a planet, an organism, or a nation: "From the lowest living forms upwards, the degree of development is marked by the degree in which the several parts constitute a co-operative assemblage – are integrated into a group of organs that live for and by one another" (FP 115). Spencer is seeking again the most general and comprehensive principles by which the phenomenon of "Life" (a word he comes to be suspicious of[8]) can be understood, for example, "integration" and "differentiation." His central and most well-known claim is that in evolution there is a change from the homogeneous to the heterogeneous. We see this, he contends, in the case of the human animal, in the progress of every tribe and nation as well as every civilization (FP 122). The initial definition of "evolution" can now be finessed, then, as a change from an indefinite, incoherent homogeneity to a definite, coherent heterogeneity (FP 127, 138).

Spencer's *The Principles of Biology* takes the form of a theoretical inquiry into the meaning of life and not a contribution to the growth of any particular biological science.[9] His specific aim was to combat the "continental" tradition of inquiry and deny that living things possessed meaning on account of their being directed by an internal force or power. He was keen to avoid any probing into what may lie beneath surface shapes and instead seeks to restrict knowledge, in true empiricist fashion, to what is causally visible; in short, knowledge is "superficial" and, as such, uncovers rational and functional laws.[10] Spencer places himself in opposition to two continental currents of thought: on the one hand, the philosophical idealism associated with the likes of Lorenz Oken (1779–1851) and Goethe; and, on the other hand, a materialistic current stemming from Comtean positivism. Any appeal to transcendentalism (such as a vital principle of Life **[514]**) was to be avoided, along with innate principles and teleological perfection. At the same time, a crude positivism that held life to be meaningless was also to be avoided. There is "meaning" in life but this will be discovered only in the detailed interpretation of the functions and structures of life, such as plants and animals, and in the examination of their relations with an environment.[11] Life is not a separate force and the science of biology will demonstrate that living things are all subject to the same laws as the rest of the

8. See M. Francis, *Herbert Spencer and the Invention of Modern Life* (Stocksfield: Acumen, 2007), 206, 226.
9. *Ibid.*, 211.
10. *Ibid.*
11. *Ibid.*, 212.

physical universe: "Nothing would be hidden; for Spencer the meaning of life was plainly visible in the forms and structures of the material world."[12] Where Spencer is radical is in his denial that classifications of living forms correspond to anything natural in the world; systems of classification are an artificial means for organizing our knowledge. The further we carry the analysis of things, he holds, the more obvious it becomes that divisions and classifications are essentially human inventions and scientific artifices by which we limit and arrange the matter under investigation and as a way of facilitating human inquiry.

The issue that intrigues Spencer in *The Principles of Biology* is not the natural selection of species but species' self-persistence and perpetuation; in short, their continuation over time. This means, therefore, focusing on the "static" aspect of Life [515]. He explains the exhibition of species' stability by recourse to a vital impulse, which he calls the protoplasm, but this impulse is not progressive, that is, it is an agent not of change but of stasis. For him what causes change is not the inner life force but some harsh novelty caused in the environment that serves to jerk a species out of equilibrium. Evolution, then, exhibits no drive towards perfection. On this issue he takes his inspiration from Darwin: evolution does not work toward specific goals. Moreover, "Spencer's biological evolution had become a matter of responses to physical forces that shaped or formed organic entities in the same way they did inorganic ones."[13] Curiously though, he holds to the view that the evolutionary destiny of human beings is separate from the rest of nature. His hope is that in time evolution will move beyond its "red in tooth and claw" character and result in the general abolition of "evil," or life beyond the cruelty, competition, pain, and fear that characterize nature.[14]

BERGSON'S *CREATIVE EVOLUTION*

Bergson began his intellectual life as a follower of Spencer but soon broke with him on core philosophical issues. In *Creative Evolution*, while acknowledging the powerful attraction Spencerian evolutionism has exerted on contemporary thought, he goes so far as to contend that this evolutionism deals in fact neither with becoming nor with evolution (CE 232). We shall return to his criticism of Spencer later in the next section. First, it will be helpful to provide insight into some of the main arguments of Bergson's great text, the text that turned him into a philosophical sensation in his own time and which various biologists of our own time, such as Steven Rose, Brian Goodwin, and Mae-Wan Ho, refer

12. *Ibid.*
13. *Ibid.*, 218.
14. *Ibid.*, 221, 225.

to as containing rich resources for understanding the evolution life as an open, dynamical system.

Bergson may well be the most important philosopher of life in the twentieth century, the one most seriously committed to it for philosophical ends. *Creative Evolution* was an audacious work when it was first published in 1907, and it remains so today. Here we encounter a continental philosopher taking seriously the insights of modern evolutionary theory and biology, attempting to assess their implication for matters of concern to philosophy, and seeking to demonstrate how philosophy can illuminate and clarify our thinking of life in its evolutionary aspects. Bergson is not afraid to speculate. However, for him "speculation" should be neither abstract nor idle but grounded in facts that are empirically intelligible and testable. In *Creative Evolution,* Bergson attempts to show that the problem of knowledge, the problem of accounting for the faculties of intellect (*intelligence*) and intuition, is one with the metaphysical problem of gaining access to the real: the two form a circle, the center of which is "the empirical study of evolution." The double form of consciousness (intuition and intellect) is shown to reveal "the double form of the real" itself (dynamic and static). For Bergson, intellect only reveals the static aspect of reality, but through intuition we may gain access to the dynamic reality that intellect misses. The attempt to demonstrate this constitutes what we might call the Bergsonian Revolution. It is an effort to enter "into life's own domain," conceived as "reciprocal interpenetration, indefinitely continued creation" (CE 115). Life is to be approached as a "current of creative energy … precipitated into matter" that endeavors "to wrest from it [matter] what it can" (CE 209).

The significance of the science of the nineteenth century for Bergson is that it places at the center of its inquiry the "study of living beings." He concedes that even here science may still be governed by mechanics but what we are dealing with is a mechanics of transformation, which is a mechanics that cannot be developed by relying on geometrical and spatialized schemas of thought. Change, transformation, and evolution are bound up with living and open systems, and the features of novelty that characterize such systems will always elude a mathematical treatment. A major critical point that Bergson makes in *Creative Evolution* concerns the way in which an exclusively physico-chemical study of organisms cannot grasp the real growth and change that are essential to life, because it treats its object of study – be it a single cell or a whole organism – mathematically, that is to say, as a constant, isolable, and self-identical unit. For Bergson, the physical sciences become merely symbolic when they treat life, which displays dynamic properties, within this static framework. Further, if science claims that it is justified in doing so because life *is* essentially mathematical, it ceases to be descriptive and becomes hypothetical. Through his studies of cytology, embryology, and paleontology, Bergson is well aware that the evidence

suggests the contrary, that life is *not* essentially mathematical. In Bergson's terms, treating life within a static mathematical framework is dogmatic, and betrays a metaphysics that haunts science.

In an unorganized body or material object, Bergson accepts that change may be only a displacement of the ultimate parts of which an object is made, parts that themselves do not change, meaning there is no real growth, no history, nothing to prevent the object returning to its previous state (CE 5). What biology reveals, for Bergson, is that living organisms do not change through a mere rearrangement of parts, but that each part itself changes by splitting in an unpredictable way. Hence "the distinctive feature of the organized body is that it grows and changes without ceasing" because this growth or change "does not proceed by the association and addition of elements but by dissociation and division" (CE 9, 58 **[516]**). This means that unlike unorganized matter, change in living systems cannot be charted and predicted as a rearrangement of parts because the parts themselves do not remain unchanged throughout the process. Indeed, they do not even remain self-identical, as it is their nature to multiply: "because there are several individuals now, it does not follow that there was not a single individual just before … it was *one* in the first instance and afterwards *many*" (CE 9). For Bergson, this is not a hypothesis: it is observable fact, evident in cell division, in the development of the embryo, and in the evolutionary process of speciation. In each case we see that what was once one is now literally two (or four, or eight, etc.). Thus, the very language of ultimate parts with a constant numerical value, which is the basis of a mathematical treatment, cannot express this process in which the parts that we identify continually multiply, and what is more, multiply in an unpredictable way.[15]

In contesting a purely mathematical treatment of life Bergson does not, as has been widely supposed, espouse a naive vitalism. Vitalism entails an appeal to some mysterious vital stuff that is then held to be the transcendent motor or agent of evolution, while Bergson explicitly eschews any appeal to a vital force or principle. He notes that when the mind considers the infinity of infinitesimal elements and causes that come together in the genesis of a living being, in which the absence or deviation of any one of them would ruin everything, its first impulse is to take "this army of little workers as watched over by a skilled foreman, the 'vital principle,' which is forever repairing faults, correcting effects of neglect or absentmindedness, putting things back in place" (CE 145). For Bergson, however, there is no such foreman, nor are there any workers that

15. We should note that mathematics has found new applications since Bergson's time, and that within complexity theory in particular it is now used to model the behavior of systems that are held to be in principle dynamic and unpredictable, while in fact giving rise to patterns of regularity – a view that is very close to Bergson's own, but which the mathematics of his day did not entertain.

need such supervision. Furthermore, "the position of vitalism is rendered very difficult by the fact that, in nature, there is neither purely internal finality nor absolutely distinct individuality" (CE 27).

Bergson claims that time has not been taken seriously in previous science. He contends that both common sense and science deal with isolated systems, which are systems that realize themselves in the course of time. Time is reduced to a process of realization on account of the fact that mechanical explanation treats both the past and the future as calculable functions of the present. As a result, time is deprived of efficacy and, in effect, reduced to nothing, having just as much reality for a living being as an hourglass. This is true of both mechanism and finalism for Bergson. Indeed, he contends that finalism is merely an inverted mechanism, substituting the attraction of the future for the compulsion of the past and conceiving the order of nature on the model of a realization of a plan. Bergson claims that both mechanism and finalism are, ultimately, attempts to conceive evolution along the lines of the workings of the human mind (for good reasons did Emmanuel Levinas locate in Bergson's text a source for Heidegger's question concerning technology).[16] He thus claims, somewhat radically, that mechanism's reproach against finalism – that it is anthropomorphic – can also be applied to mechanism itself. Both conceive of nature working like a human being in bringing parts together and proceeding via association and the addition of elements. Bergson suggests that a glance at the development of an embryo will readily show that life works in a very different manner, namely, via dissociation and division (self-differentiation).

Bergson's conception of life draws heavily on his notion of a virtual multiplicity made up of heterogeneous elements, in which the relations between them are ones of fusion and interpenetration. Considered in terms of its contact with matter, life can be likened to an impetus or an impulsion that in itself "is an immensity of potentiality [*virtualité*], a mutual encroachment of thousands and thousands of tendencies," which are such only when spatialized (CE 165–6). It is matter that carries out in actuality the division of this virtual multiplicity, and individuation is to be treated as in part the work of matter and in part the result of the inclination of life. In the opening part of *Creative Evolution*, Bergson states that there is no universal biological law that applies "precisely and automatically to every living being." Rather, "there are only *directions* in which life throws out species in general" (CE 10–11). This seemingly innocuous statement provides the key to understanding Bergson's attempt to stage an encounter between the discoveries of modern biology and an enlarged perception of the "whole" of life and evolution, one that endeavors to go beyond the uncritical assumptions of "evolutionist philosophy" (the reference is to Spencer).

16. See Levinas's interview with Richard Kearney, "Dialogue with Emmanuel Levinas," [517], 13.

What challenge to thought did Bergson think the new biology presented? First, and most obviously, there is the rejection of Aristotle's thinking. In his discussion of the development of animal life in chapter two of *Creative Evolution*, he says that the cardinal error that has vitiated almost all philosophies of nature from Aristotle onward lies in seeing in vegetative, instinctive, and rational life successive degrees in the development of one and the same tendency. In fact, they are "*divergent directions of an activity that has split up as it grew*" **[518]** (CE 88). This is in accord with one crucial aspect of his conception of "life," namely that it proceeds not by the association and addition of elements but by dissociation and division. Bergson argues that one of the clearest results of modern biology is to have shown that evolution has taken place along divergent lines (CE 113). This means that it is no longer possible to uphold the biology of Aristotle in which the series of living beings is regarded as unilinear.

The second challenge to thought raised by the new biology was located in the modern doctrine of "transformism," a doctrine that Bergson says he accepts "as a sufficiently exact and precise expression of the facts actually known" (CE 15). On the one hand, it shows us that the highest forms of life – highest in terms of complexity – emerge from a very elementary form of life, thus "the most complex has been able to issue from the most simple by way of evolution." On the other hand, it shows that life can no longer be treated as an abstraction. Life can now be described in terms of the continuity of genetic energy that cuts across the bodies "it has organized one after another, passing from generation to generation, [and that] has become divided among species and distributed amongst individuals without losing anything of its force, rather intensifying in proportion to its advance" (CE 17).

Bergson insists that we need to display a readiness to be taken by surprise in the study of nature and life and learn to appreciate that there might be a difference between human logic and the logic of nature. We cannot approach nature with any *a priori* conceptions of parts and wholes or any *a priori* conception of what constitutes life, including how we delimit the boundaries of an organism and hence define it. We must resist the temptation to place or hold nature within our own ideas or shrink reality to the measure of them. We should not allow our need for a unity of knowledge to impose itself on the multiplicity of nature. Life challenges the essential categories of thought: unity, multiplicity, mechanical causality, intelligent finality all fall short. A consideration of life in its evolutionary aspects makes it virtually impossible to say where individuality begins and ends, whether the living being is one or many, whether it is the cells that associate themselves into an organism or the organism that dissociates itself into cells. Unity and multiplicity, or the one and the many, are categories of inert matter; the vital impetus can be conceived as neither pure unity nor pure multiplicity.

The need for a new thinking of life arises for Bergson, in particular, out of the deficiency of the intellect and its inability to think duration.

> The more duration marks the living being with its imprint, the more the organism differs from a mere mechanism, over which duration glides without penetrating. And the demonstration has most force when it applies to the evolution of life as a whole … inasmuch as this evolution constitutes, through the unity and continuity of the animated matter which supports it, a single indivisible history. (CE 24)

Time is written and engrafted – it is inscription: "*Wherever anything lives, there is, open somewhere, a register in which time is being inscribed*" **[519]** (CE 11). Bergson insists that this is no metaphor; rather, it is of the essence of mechanism to consider as metaphorical every effort to ascribe positive attributes to time. For mechanism, change is reducible to an arrangement or rearrangement of parts, while the irreversibility of time is depicted as an appearance relative to our ignorance. But if there is no direction of time for physics, this cannot be the case for biology. On every level we care to examine it, be it embryology, morphology, or the process of evolution itself, time is the indicator of life and of individuated living systems. This inscription and recording of time is, in fact, the time and place of the vital:

> [W]hat is properly vital in growing old is the insensible, infinitely graduated, continuance of the change of form … The evolution of the living being, like that of the embryo, implies a continual recording of duration, a persistence of the past in the present, and so an appearance, at least, of organic memory. (CE 13)

BERGSON ON SPENCER'S EVOLUTIONISM

Bergson opposes his conception of evolution to the Spencerian one, arguing that Spencer's method consists in reconstructing evolution with fragments of the evolved (CE 232). In short, Bergson's argument is that Spencer is unable to think genuine evolution since he lacks a principle of genesis and instead supposes that we can posit at the beginning what can only be the result of an actual evolution:

> Already, in the field of physics itself, the scientists who are pushing the study of their science furthest incline to believe that we cannot reason about the parts as we reason about the whole; that the same

> principles are not applicable to the origin and to the end of a progress; that neither creation nor annihilation, for instance, is inadmissible when we are concerned with the constituent corpuscles of the atom. Thereby, they tend to place themselves in the concrete duration, in which alone there is true generation and not only a composition of parts. (CE 235)

For Bergson, the illusion is generated when we define the evolution of life as a passage from the homogeneous to the heterogeneous. In effect, he is criticizing a specific variety of finalism, what Stephen Jay Gould and Richard C. Lewontin baptized "the Panglossian paradigm" or "adaptationist program":

> We call it the adaptationist programme, or the Panglossian paradigm [which] is rooted in a notion popularized by A. R. Wallace and A. Weismann, (but not, as we shall see, by Darwin) toward the end of the nineteenth century … This programme regards natural selection as so powerful and the constraints upon it so few that direct production of adaptation through its operation becomes the primary cause of nearly all organic form, function, and behavior."[17]

However, Bergson is not being completely fair to Spencer since the principle of the passage from the homogeneous to the heterogeneous does not, in fact, specify the evolution of life but is to be applied to the physical universe. It is not the simplistic idea Bergson takes it to be, since before the invention of statistical mechanics it was not possible to understand life, or the formation of the solar system in our galaxy, except as a simple growth of entropy or of homogeneity in a closed system. Life needs an open structure to evolve, and this means for Spencer that evolution cannot be a closed system. For example, living organisms, which are made of "crystalloids" and "colloids," integrate nitrogenous compounds to which, through the absorption of heat, they add more motion. In short, they are not simple monatomic closed gas systems but are open systems. This means that "living aggregates" are not simply to be thought as "associated facts."[18] By this process a variety of heterogeneous elements and of heterogeneous functions in the same organism come to be diversely proportioned in diverse places and rendered more complex by evolution.

17. S. J. Gould and R. C. Lewontin, "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of The Adaptationist Programme," *Proceedings of The Royal Society of London, Series B* **205**(1161) (1979), 584–5.
18. H. Spencer, *The Principles of Biology: Volume One* (London: Williams & Norgate, 1864), para. 104.

The details of Spencer's account of the evolution of life cannot be traced here. Bergson takes issue with it for a specific reason: the concepts that Spencer utilizes to account for evolution in the direction of the heterogeneous, such as integration, equilibrium, and maximization, and which come from the integral calculus, suggest that the process of evolution can be explained and *predicted* by natural laws (which are not laws of fate). Darwin, it needs to be noted, does not conceive of evolution in these terms. Although he admits the existence of natural laws, and endeavors to come up with a theoretical explanation concerning the origin of new species, he does not connect this explanation with a possible prediction of evolution. Darwin does not accept the idea of an intelligent design, such as an omniscient Creator who could have foreseen every consequence resulting from the laws he imposes.[19] He thus takes issue with the idea that evolution could have been intentionally ordered. Had this been the case, natural selection would not be the law or mechanism by which the Creator achieves his design because natural selection would not have been foreseen at the beginning.[20] Of course, Darwin did not hold this position from the start of his intellectual inquiries but came to it gradually as a result of intense and searching reflection. His mature stance is that the good of each being depends on the way by which this good is selected. Moreover, different ways of selection give different meanings to the concept of goodness, so that good and bad, fitting and ill-fitting, are *emergent properties*. This means that the substrate is not neutral. Rather, it can change in different circumstances.

What, then, as Daniel Dennett puts it, is Darwin's most dangerous idea? Is it that natural selection acts only through and for the good of each being, or for the good of a species, but without any intention? If so, we can then conclude, as does Dennett, that natural selection acts as a mindless and mechanical meta-engine that modifies biological engines, which in turn generate the growth in complexity and adaptability.[21] Dennett advances his idea of the accumulation of design based on a mindless algorithm in contraposition to the conception of

19. C. Darwin, *The Variation of Animals and Plants under Domestication* (London: J. Murray, 1868), vol. 2, 427.
20. *Ibid*., 428.
21. Dennett writes: "Here, then, is Darwin's dangerous idea: the algorithmic level *is* the level that best accounts for the speed of the antelope, the wing of the eagle, the shape of the orchid, the diversity of species, and all the other occasions for wonder in the world of nature. … No matter how impressive the products of an algorithm, the underlying process always consists of nothing but a set of individually mindless steps succeeding each other without the help of any intelligent supervision; they are 'automatic' by definition: the workings of an automaton" (*Darwin's Dangerous Idea: Evolution and the Meanings of Life* [London: Allen Lane, 1995], 59). According to Dennett, the key lesson to be learned from Darwin's revolution is this: Paley was right in holding Design **[520]** to be not only a wonderful thing but also to involve intelligence. Darwin's contribution was to show that this intelligence could be broken up into "bits so tiny

a creative order that produces novelty from nothing that he attributes to Gould. In Dennett's view, natural selection is a crane and not a skyhook, and this means that natural selection is just a functional property that is not directly connected with its material structure. Like different clocks that can all keep good time, natural selection can be realized by different natural substrates. This is the argument of "substrate neutrality."

However, one of Bergson's main arguments is that time is acting in biology and so we need to pay attention to what natural selection is doing in each specific set of circumstances: evolution is never ready-made but always making itself. The Darwinian tree of evolution is full of singularities; it does not lead to a state in which all possible events are equiprobable. New "possibles" for life are invented. To conceive this, we need only think about genes that are not eternally conserved but can be modified; or let us think about how the world of RNA has been changed in the world of DNA. Bergson's insight into "creative evolution," then, is that constraints in biology do not have the same meaning they have in classical physics because they are *flexible*.

The reduction of real complexity to mathematical computation is one that Bergson locates in both nineteenth-century physics and biology. He quotes the following passage from Emil Du Bois-Reymond's *Über die Grenzen des Naturerkennens* of 1892:

> We can imagine the knowledge of nature arrived at a point where the universal process of the world might be represented by a single mathematical formula, by one immense system of differential equations, from which could be deduced, for each moment, the position, direction, and velocity of every atom of the world. (CE 25)

Life cannot be understood simply in terms of a mechanical realization of pre-existing goals or problems. Rather, the problems of life are general ones, evolving within a virtual field that is responded to in terms of specific solutions.[22] Bergson's main argument, then, is that to adequately conceive of life we need to appeal to a duration in which novelty is constantly springing forth and in which evolution is genuinely creative.

---

and stupid that they didn't count as intelligence at all, and then distributed through space and time in a gigantic, connected network of algorithmic process" (*ibid*., 133).

22. An example to illustrate this would be cases of convergent evolution, such as the eye, representing solutions to general problems that are common to different phylogenetic lineages, in this case that of light and the tendency "to see," or vision, and which involve a heterogeneity in the mechanisms actually involved.

ON THE SIGNIFICANCE OF EVOLUTION

At the end of chapter three of *Creative Evolution*, Bergson turns his attention to a consideration of the question of the "significance" (*signification*) of evolution, and the way in which this is revealed in "man." This should not be taken to reintroduce teleology or anthropomorphism into evolution, for Bergson states that it is in a "quite special sense that man is the 'term' and 'end' of evolution." How then, is this "special sense" to be understood? He is not, of course, claiming that the phenomenon of human consciousness mysteriously lies at the very beginning of the evolution of life as some kind of concealed destiny. His point is that the key characteristics of consciousness – indetermination, hesitation, delay, the quantity of choice with respect to a field of action, and so on – are also tendencies or potentialities of life itself (life as a current of "creative" energy). It is in this specific sense that Bergson argues that consciousness – and what he calls "supra-consciousness" (*supraconscience*) – lie at the very origin of life. This expanded notion of consciousness means before all else an "exigency of creation" that can become manifest to itself only where creation is possible: "It lies dormant when life is condemned to automatism; it wakens as soon as the possibility of a choice is restored" (CE 261). Bergson is not suggesting that the evolution of life miraculously transcends the domain of contingency and accident in order for consciousness to realize itself. Evolution remains contingent in every aspect, and Bergson is not reintroducing teleology when he locates man as the "end" of evolution. Rather, he maintains that with the human being the "life" of consciousness reaches, at least potentially, its highest state of emancipation from the restrictions imposed on it by matter. He accepts that "there has not, properly speaking, been any project or plan" (CE 265), and that the evolution of life "takes directions without aiming at ends" (CE 102). Indeed, it is a crucial aspect of his conception of a creative evolution, be it a question of a work of nature or a work of art, that forms are created without an end in view, and Bergson works out his account of the significance of man in the context of a treatment of the part played by contingency in evolution, which he takes to be enormous and extends as far as life assuming a carbonic form and being developed and concentrated in organisms.

In his book *Wonderful Life*, Gould suggests that the fossils of the Burgess Shale challenge the traditional frameworks of progress and predictability for interpreting evolutionary history, revealing instead that the nature of that history is essentially contingent. The reason these fossils demand a new explanatory framework is because they show that the diversity of life during the "Cambrian explosion" – the earliest known proliferation of multi-cellular organisms – was

much greater than it is today.[23] Today, there are thought to be twenty to thirty different phyla (basic anatomical designs) within the animal kingdom. What the Burgess fossils reveal is that at the very origin of the animal kingdom there were at least fifteen to twenty additional phyla. On the basis of this evidence, Gould rejects what he calls "the ladder of progress" and "the cone of increasing diversity" as models of evolutionary change[24] and develops a new explanatory framework in which diversification (of species) follows only from a prior decimation (of phyla). He states that it was a lottery as to which phyla survived[25] and does not shy away from the implications this has for our understanding of ourselves as human beings and our place in evolution:

> Invariant laws of nature impact on the general forms and functions of organisms; they set the channels in which organic life must evolve. … But the physical channels do not specify arthropods, annelids, mollusks and vertebrates, but, at most, bilaterally symmetrical organisms based on repeated parts. The boundaries of the channels retreat even further into the distance when we ask the essential questions about our own origin: Why did mammals evolve among vertebrates? Why did primates take to the trees? Why did the tiny twig that produced *Homo Sapiens* **[521]** arise and survive in Africa? When we set our focus upon the level of detail that regulates most common questions about the history of life, contingency dominates and the predictability of general form recedes to an irrelevant background.[26]

Gould's account of the decimation of phyla, among which humanity's distant ancestors must have survived, coupled with the contingency of our subsequent evolution, leads him to take seriously the contingency of the human mind itself:

23. More specifically, the number of phyla, or basic anatomical designs, was much greater during the Cambrian explosion, while today there are thought to be a greater number of species based on fewer phyla. See S. J. Gould, *Wonderful Life: The Burgess Shale and the Nature of History* (London: Century Hutchinson, 1989), 98–100.
24. Bergson himself explicitly rejected the ladder of progress and the cone of diversity as images of evolutionary development in *Creative Evolution*: "the impression derived [from the study of organisms] is not always that of an increasing complexity … Nor does it suggest the idea of steps up a ladder" (CE 110).
25. As Gould says, "We do not know for sure that the Burgess decimation was a lottery, but we have *no evidence* that the winners enjoyed adaptive superiority," **[522]** nor is there evidence that the survivors could have been predicted on the basis of any prior characteristic: "twentieth-century paleontology portrays the Burgess losers as adequately specialized and eminently capable" (*Wonderful Life,* 239).
26. *Ibid*., 289–90.

"wind back the tape of life to the early days of the Burgess Shale; let it play again from an identical starting point, and the chance becomes vanishingly small that anything like human intelligence would grace the replay."[27] What would grace the replay then? What would take our place? Gould does not develop a positive account of the alternatives except to infer rightly from the extinct members among the Burgess fossils that they would be forms of life radically different from the vertebrates, mollusks, arthropods, and so on, that are familiar to us today.

How is it, then, that if Bergson acknowledges the tremendous role played by contingency and accidents in evolution, which make it entirely conceivable that we could have evolved in ways that would make us physically and morally different from what, in fact, we are, he can also claim that man is the highest achievement of life, and as such reveals its nature most clearly? The brilliance of Bergson's account of the significance of the human is that from a comprehensive analysis of the variety of contingent evolutionary forms, he is able to discern certain functions that he sees as universal, and the expression of which is what marks out man as the most significant of its products. Hence, the empirical details of evolution constitute the factual basis not only for an understanding of the actual form of the human, but also for any speculation regarding its evolutionary significance.

Whereas it is the examination (in paleontology and comparative anatomy) of material forms that revealed contingency, it is the examination of organisms in terms of their function, and specifically their relation to energy, that allows Bergson to attribute significance to the human in particular. As Bergson says, "life as a whole, whether we envisage it at the start or at the end of its evolution, is a double labor of slow accumulation and sudden discharge" of energy. It is along these lines that Bergson distinguishes plant and animal life, which "develop two tendencies which at first were fused in one" (CE 76). The accumulation and release of energy "at first completed each other so well that they coalesced," but in the history of evolution we see that "the animal evolved … toward a freer and freer expenditure of discontinuous energy" while "the plant perfected rather its system of accumulation" (CE 76). Their tendency to emphasize different aspects of energy flow leads to the development of different modes of feeding, of movement, and ultimately of consciousness in the plant and the animal. However, his characterization of the evolution of animal life in terms of an increasing ability to use energy leads Bergson into a direct confrontation with the second law of thermodynamics, which states that all energy tends to degrade into heat, which is distributed throughout matter in a uniform manner. Bergson considers this to be "the most metaphysical of the laws of physics" because it attempts to describe

27. *Ibid.*, 14.

the very direction of existence (CE 156). While it may apply within a closed material system – which Bergson describes as "a thing unmaking itself" (CE 157) – it does not apply to life, in which we find an effort to remount the incline that matter descends and that in its creative passage through matter is "*a reality which is making itself in a reality which is unmaking itself*" [523] (CE 159).[28]

Is Bergson here, for once, in direct contradiction to empirical evidence? His is an extreme claim, and demands some kind of support. This can be provided, however, by Mae-Wan Ho, one of the few biologists to adopt Bergson's work as a valid resource within science. In *The Rainbow and the Worm*, Ho develops an account of living systems in terms of non-equilibrium thermodynamics. Like Bergson, she claims that living organisms are "irreconcilable with the statistical nature of the laws of thermodynamics," hence those laws cannot be applied to life without some reformulation, which Ho develops under the name "a thermodynamics of organized complexity."[29] The difference for Ho is this: whereas in material systems, energy tends toward undifferentiated distribution or "equilibrium" as stated by the second law of thermodynamics, living systems are highly differentiated as a consequence of the way "energy flow organizes and structures the system in such a way as to reinforce the energy flow."[30] For this to work, an organism's ability to store energy is key. Hence, in Ho's definition, an organism is a coherent structure maintained far from thermodynamic equilibrium by the ability to store energy, and then release it in a way that magnifies its effect well beyond any potential it would have had in a purely material context. Bergson's description of animal life as a counter-entropic movement can be refined through Ho's work, into an account of life as a local magnification of potential energy resulting through the differentiation of storage and release.

The excess of energy that the animal has at its disposal is, then, the condition for the development of human freedom as much as the brain itself. That is to say, human consciousness is not only to be explained with reference to its material conditions, but also to the contingent conditions of its evolutionary history. Gould too has noted this: "We shall then finally understand that the answer to such questions as 'Why can humans reason?' lies as much (and as deeply) in the quirky pathways of contingent history as in the physiology of neurons."[31]

28. For Bergson's discussion of Boltzmann's interpretation of the second law of thermodynamics, see CE 157.
29. M.-W. Ho, *The Rainbow and the Worm: The Physics of Organisms* (London: World Scientific, 1998), xi.
30. *Ibid.*
31. Gould, *Wonderful Life*, 281.

Hence Bergson is not being materialistic, or providing an emergent account of the mind when he argues, for example, that the difference between animal consciousness and human consciousness lies in the number and range of motor mechanisms that have been set up in the human brain, which serve to give an almost unlimited field of choice in their release. Thus, from the fact that the brains of human and ape are alike, "we cannot conclude that consciousnesses are comparable or commensurable" (CE 263), because from the limited to the unlimited there is all the distance between the closed and the open (in fact, what we have here is a difference of kind and not merely degree). Unlike the case of the animal, the powers of invention within the human are not simply variations on the theme of routine. Rather, we have a machine that has the potential to triumph over mechanism and closure. The human is not a captive of the mechanisms its brain has set up. It is as a complex, open machine, therefore, that the human can be said to be the "interesting" animal. Bergson then duly notes the importance of the role played by language, social life, and technics in the creation of this "exceptional life" of the human animal (elsewhere Bergson calls man "the sporting animal" and conceives the brain as an organ of sport).[32] The complication of the brain, for Bergson, is an effect of evolutionary freedom as much as a condition of human freedom. The development of the brain itself is contingent on the excess of energy that allows the development of free action along the animal line of evolution. The brain is not an originary material base that allows consciousness to emerge. Rather, it is material so organized by evolutionary "consciousness"[33] as to allow it to re-emerge in the human:

> Things have happened just as though an immense current of consciousness, interpenetrated with potentialities of every kind, had traversed matter to draw it towards organization and make it, notwithstanding that it is necessity itself, an instrument of freedom. But consciousness has had a narrow escape from being itself ensnared. Matter, enfolding it, bends it to its own automatism, lulls it to sleep in its own unconsciousness. … So, from the highest rung of the ladder of life, freedom is riveted in a chain which at most it succeeds in stretching. With man alone a sudden bound is made; the chain is broken.[34]

32. H. Bergson, "Psychophysical Parallelism and Positive Metaphysics," in *Continental Philosophy of Science*, G. Gutting (ed.) (Malden, MA: Blackwell Publishing, 2005), 68.
33. Again, this is not to anthropomorphize evolution: consciousness here means freedom, contingency, creation, and so on.
34. H. Bergson, *Mind-Energy***Error! Main Document Only.***: Lectures and Essays*, H. W. Carr (trans.) (Basingstoke: Palgrave-Macmillan, 2007) [525], 19.

The human form, then, is not prefigured in the evolutionary movement and cannot be said to be the outcome of the whole of evolution since this has been accomplished on several divergent lines, and the human species is simply at the end of one of them: "[man] does not draw along with him all that life carries in itself" (CE 266). Nevertheless, for Bergson man is more significant than the species that occupy the other lines of vegetable and animal evolution because he is the being in whom the vital movement of life reaches its highest expression, and hence the being in whose freedom the creative nature of evolution is made most evident. This point is worth stressing so that Bergson is not misheard when he advances these kinds of insights. There is nothing anthropomorphic in Bergson's claim that man reveals the significance of evolution, primarily because it is not the specific form of man but his function as a free and creative being that constitutes his significance. It is as if "*a vague and formless being*" (*un être indécis et flou*) **[524]** – call it, Bergson says, man *or* superman – had sought to realize itself but could succeed in this effort only by abandoning parts of itself in the process (such losses are represented by the animal and vegetable worlds and what is positive in them).

In subsequent essays and texts, Bergson does think outside the restrictions he himself had placed on speculation in *Creative Evolution*, speaking of the appearance of the human – "or of some being of the same essence" – as the "*raison d'être* of life on our planet."[35] However, we should not suppose that the metaphysician in Bergson has simply got the better of him and now overrides the stress he had previously placed on the empirical study of evolution. He still maintains that "experience is the only source of knowledge,"[36] and he seeks to develop his insights on the basis of a synthesis of an intellectual cognition of facts and the accumulation of probabilities. With the word "experience" Bergson means something rich and varied, but the objects of experience we refer to must be ones that can become objects of scientific inquiry and research. Bergson's thinking of life and of creative evolution culminates in a conception of "creative emotion" and the claim that philosophical certainty, which admits of degrees, requires the extension of intuition – supported by science – by "mystical intuition." He ends his final book, *The Two Sources of Morality and Religion* (1932), by describing the universe as a machine for the production of gods and declaring that the task now facing human beings is whether they wish to go on living or not. In order to address the tremendous social, political, and international problems of the planet, we need to refine the "spirit of invention" that to date has been cultivated largely

35. Bergson, *The Creative Mind*, 59; see also The Two Sources of Morality and Religion, pp. 255–56.

36. H. Bergson, *The Two Sources of Morality and Religion*, R. A. Audra and C. Brereton, with W. Horsfall Carter (trans.) (Notre Dame, IN: Notre Dame Press, 1977) **[526]**, 248.

on the basis of mechanism. It is not more and more reserves of potential physico-chemical energy that need releasing but those of a moral energy: "the body, now larger, calls for a bigger soul" and "mechanism should mean mysticism."[37]

It is perhaps this kind of reflection on the meaning of evolution that has generated some of the more far-out speculations we encounter in work on evolution in the twentieth century, such as the writings of Pierre Teilhard de Chardin (1881–1955), as well as in positions advanced in our own time that propose that we are currently witnessing on earth a takeover of mindless Darwinian evolution by controlled and self-directed evolution.[38] De Chardin, a priest and paleontologist, claimed to have been inspired in part by Bergson's *Creative Evolution* as well as by Nietzsche's conception of the superhuman. What concerns him most is not that there is evolution, a fact he considers indisputable, but whether evolution is directed or not. In *The Phenomenon of Man*, he holds that evolution does have a precise orientation as well as a privileged axis and he thinks that he can show this while "leaving aside all anthropocentrism and anthropomorphism."[39] In his attempt to establish his case, he resurrects almost all the notions that Darwin's revolution had cast into intellectual oblivion: "The impetus of the world, glimpsed in the great drive of consciousness, can only have its ultimate source in some *inner* principle, which alone could explain its irreversible advance towards higher psychisms."[40] In short, for de Chardin the meaning of evolution comes from it having a definite direction and this is a psychic one centered on man or, rather, consciousness and the fact that the story of life on earth is to be understood as the spreading of "spirit" around it. The future of evolution for de Chardin consists in the attainment of what he calls "super-life," which is a "superior form of existence" beyond mere survival and an opening "onto limitless psychic spaces" in the universe.[41] He explicitly uses the word "superhuman" to depict this future and speaks of it in terms of a "spiritual

37. *Ibid.*, 310.
38. In a statement that takes one's breath away on account of its reckless personification of evolution, Kevin Kelly writes: "My larger point is that the advantages of Lamarckian evolution are so great that nature *has* found ways to make it happen," and adds, "Evolution daily scrutinizes the world not just to find fitter organisms but to find ways to increase its own ability. … Evolution searches the surface of the planet to find ways to speed itself up … not because it is anthropomorphic, but because the speeding up of adaptation is the runaway circuit it rides on. … What evolution eventually found in the human brain was the complexity needed to peer ahead in anticipation and direct evolution's course. … What evolution really wants – that is, where it is headed – is to uncover (or create) a mechanism that will most quickly uncover (or create) possible forms, things, ideas, processes in the universe" (*Out of Control: The New Biology of Machines* [London: Fourth Estate, 1995], 361, 363 [527]).
39. P. Teilhard de Chardin, *The Phenomenon of Man*, B. Wall (trans.) (London: Collins, 1959), 157.
40. *Ibid.*, 165.
41. *Ibid.*, 256–7.

renovation of the earth."[42] In an attempt to add intellectual substance to his ill-defined concerns, de Chardin comes up with an armory of strange new terms, such as the noosphere and the Omega Point,[43] and together they are meant to support his claim that evolution can be interpreted as the story of the ascent of consciousness and spirit that culminates in an era of "hyper-personalization"[44] – or, one might say, Hegel meets biology and evolution: "There can be no doubt about it," he claims after stating that modern totalitarianism is the distorted truth of something magnificent, "the great human machine is designed to work and *must* work – by producing a super-abundance of mind." [528][45]

De Chardin's appreciation lacks the subtlety of Bergson's speculations about the significance of evolution and the possible "meaning" within it of the appearance of the human. Moreover, he fundamentally distorts the sense of Nietzsche's "superhuman" figure. For Nietzsche, of course, the emphasis is to be placed on the *body*, not on consciousness or spirit,[46] and he was keen to separate his idea from association with evolutionary thought, insisting that the question to be posed was not what should now replace or succeed humanity in the order of being, but rather what kind or type of human should now be willed and bred as having greater value and being more certain of a future.[47]

DELEUZE AND BERGSONISM

The influence of Bergson on Deleuze cannot be underestimated. Indeed, Alain Badiou calls Bergson Deleuze's "real master, far more than Spinoza, or perhaps

42. *Ibid*., 269.
43. By "noosphere," de Chardin means a new era in evolution centered on the emergence of the "thinking layer" or the "soul" of the Earth and achieved through hominization: "outside and above the biosphere there is the noosphere" (*ibid*., 202). The "Omega Point" names the centered point around which the noosphere revolves, namely, consciousness as "hyper-personalization": "Because it contains and engenders consciousness, space-time is necessarily *of a convergent nature*. Accordingly its enormous layers, followed in the right direction, must somewhere ahead become involuted to a point which we might call *Omega*, which fuses and consumes them integrally in itself" (*ibid*., 285). In short, de Chardin is claiming that the more the "sphere" of the world expands and grows in consciousness, the richer and deeper it becomes and is concentrated at a point that allows us to speak of "the volume of being."
44. *Ibid*., 284–5.
45. *Ibid*., 82.
46. In a note of 1883–84, Nietzsche writes: "we are in the phase of the modesty of consciousness … Put briefly: perhaps the entire evolution of the spirit is a question of the body … The organic is rising to yet higher levels. Our lust for knowledge of nature is a means through which the body desires to perfect itself … In the long run, it is not a question of man at all: he is to be overcome" (Nietzsche, *The Will to Power*, §676).
47. Nietzsche, *The Antichrist*, §2.

even Nietzsche."[48] He further insightfully notes that it was Deleuze's immense merit to have "modernized the Bergsonian filiation." He did this by extricating Bergson from what he had laid himself open to:

> a recuperation of the injunctions of the Open [an important category in Bergson's *The Two Sources of Morality and Religion*] by Christian spiritualism and an adjustment of his cosmic vision to a certain global teleology of which Father Teilhard de Chardin was for a time the herald.[49]

According to Badiou, then, Deleuze's appropriation of Bergson is of great significance since it "secularizes" him and in so doing connects his concepts "to the creations at the forefront of our time."[50]

Deleuze identifies a number of philosophical innovations in Bergson's project and he accords a special importance to the accomplishment of *Creative Evolution*, locating in it the seeds of a new thinking of difference and the prospect of thinking beyond the human condition (beyond, that is, our spatialized habits of representation). There are a number of places in his writings where Bergson explicitly approaches philosophy as the discipline that "raises us above the human condition" (*la philosophie nous aura élevés au-dessus de la condition humaine*) and makes the effort to "surpass" (*dépasser*) the human condition.[51] In *Creative Evolution*, Bergson conceives philosophy as "an effort to dissolve again into the Whole." Moreover: "Intelligence reabsorbed into its principle, may thus live back again in its genesis" (CE 123). Such a method of thinking has to work against the most inveterate habits of the mind and consists in an interchange of insights that correct and add to each other. For Bergson, as Deleuze notes, such an enterprise ends by expanding the humanity within us and so allows humanity to surpass itself by reinserting itself in the Whole.[52] This is accomplished through philosophy for it is philosophy that provides us with the means (methods) for reversing the normal directions of the mind (instrumental, utilitarian), so upsetting its habits. Deleuze stresses that for Bergson this makes philosophy's task a modest one. If we suppose that philosophy is an affair of perception, then it cannot simply be a matter of correcting perception but only of extending it. There is nothing at fault with the human condition, and its

48. A. Badiou, *Deleuze: The Clamor of Being*, L. Burchill (trans.) (Minneapolis, MN: University of Minnesota Press, 2000), 39.
49. *Ibid*., 99.
50. *Ibid*.
51. Bergson, *The Creative Mind*, 50, 193. **[529]**
52. CE 124; G. Deleuze, "Lecture Course on Chapter Three of Bergson's *Creative Evolution*," B. Loban (trans.), *Substance* **36**(3) (2007), 79–80.

fundamental errors and habits do not require correction. Rather, the task is to extend the human present, which is the aspect of time in which the human necessarily dwells, a necessity to be explained through the dictates of evolution such as adaptation: "The human condition is the maximum of duration concentrated in the present, but there is no co-exclusivity to being, that is to say that there is not only the present."[53]

For Deleuze, Bergson's philosophy contains a new thinking of difference: "The notion of difference must throw a certain light on Bergson's philosophy, but inversely Bergsonism must bring the greatest contribution to a philosophy of difference."[54] It is a quasi-phenomenological venture since the aim, Deleuze declares, is to "return" to things themselves. The promise, if this is got right, is nothing less than one of difference delivering Being **[530]** to us. A careful consideration of the differences of nature will lead us to the nature of difference. Hitherto, thinking has confused two kinds of differences and covered one over with the other: differences of degree over differences of kind or nature. The task of philosophy is to grasp the thing itself in its positivity, and this requires a notion of internal difference. Deleuze fully appreciates that a certain strand of modern philosophy finds such a notion of difference to be absurd. In the Hegelian schema of difference, a thing differs from itself only because it differs in the first place from all that it is not. Difference is, therefore, said to be constituted at the point of contradiction and negation. The novel modernity of Bergsonism lies, for Deleuze, in its critique of metaphysics and of a science that has forgotten the durational character of life and imposed on it an abstract mechanics. It rests on a schema that homogenizes difference by selecting only differences of degree through a spatialized representation of the real. General ideas simply present for our reflection completely different givens that get collected in utilitarian groupings. The task for Deleuze is one of breaking out of a merely "external state of reflection," so that philosophy no longer has a merely negative and generic relation with things in which it remains entirely in the element of generality.

For Deleuze the ultimate aim is to re-connect human thought and existence to, as he puts it, the "universal consciousness" of the Whole (*le Tout*). If Nietzsche's philosophy rests on an inversion of Platonism and a parody of metaphysics, the Bergsonian has found a different path, one that is able to articulate a philosophy of becoming that enables us to reverse the normal directions of thinking and its spatial habits. As Deleuze points out, for Bergson metaphysics begins not with Plato but with Zeno.[55] In his work on Bergson, Deleuze's singular contribution

53. Deleuze, "Lecture Course on Chapter Three," 79.
54. G. Deleuze, "Bergson's Concept of Difference," M. McMahon (trans.), in *The New Bergson*, J. Mullarkey (ed.) (Manchester: Manchester University Press, 1999), 42.
55. "Metaphysics dates from the day when Zeno of Elea pointed out the inherent contradictions of movement and change, as our intellect represents them" (Bergson, *The Creative Mind*, 17);

is his ability to see with tremendous clarity the significance of Bergson's project for philosophy. In his 1960 lecture course on *Creative Evolution*, Deleuze indicates precisely where Bergson's importance lies, namely in the effort to radicalize the post-Kantian project commenced by Solomon Maimon and J. G. Fichte: the need to pass from a transcendental philosophy to a genetic one.[56] Exposing the "myth of the given" has, of course, been a preoccupation of a great deal **[531]** of twentieth-century philosophy and with respect to both analytical and continental sources of thought. Deleuze focuses attention in large measure on the nature of Bergson's singular contribution to this project. Neither the intellect nor matter can be taken as given (today the polarity is cashed out as one of "mind" and "world'); rather, there is a need for a double genesis. It is this conception of genesis that constitutes such an essential aspect of the Bergsonian revolution. If successful, it means that we will be able to enter into the Whole, or what Deleuze calls the universal consciousness of Life. Deleuze stresses that the Whole enjoys neither interiority nor totality; individuated forms of Life have a tendency toward closure but this is never accomplished on account of Life. As Bergson puts in *Creative Evolution*, "finality is external or it is nothing at all" (CE 27). That the Whole is not given should fill us with delight since it is only our habitual confusion of time with space, and the assimilation of time into space, that makes us think the Whole is given, if only in the eyes of God.[57]

Informing Deleuze's Bergsonism is a philosophical critique of the order of need, action, and society that predetermine **[532]** us to retain a relationship with things only to the extent that they satisfy our interest, and of the order of general ideas that prevent us from acquiring a superior human nature. This "ethical" impulse of Bergsonism has been taken up, as we shall now see, within contemporary biology.[58]

---

and, "Metaphysics … was born of the arguments of Zeno of Elea on the subject of change and movement. It was Zeno who, by drawing attention to the absurdity of what he called movement and change, led the philosophers – Plato first and foremost – to seek the true and coherent reality in what does not change" (*ibid.*, 141).

56. Deleuze, "Lecture Course on Chapter Three," 77–8.
57. G. Deleuze, *Bergsonism*, H. Tomlinson and B. Habberjam (trans.) (New York: Zone Books, 1988), 104.
58. Deleuze continues his interest in Bergson and in evolution, including Darwinism and other models of life such as the ethological one provided by **[534]** von Uexküll and his *Umwelt* research, in his subsequent texts such as *Difference and Repetition* (1968) and, with Félix Guattari, *A Thousand Plateaus* (1980).

"CREATIVE EVOLUTION" [533] TODAY: BERGSON AND CONTEMPORARY BIOLOGY

A major innovation of Bergson's work on biology is the shift away from a focus on parts and toward the view that it is the whole that is important. This is not to say that the analytic study of the parts of organisms, or of organisms as parts of evolution, is unimportant to Bergson, but that such research must itself take its direction from the whole context within which the parts find their sense. In *Creative Evolution* this move is evident in Bergson's definition of life as a whole that splits up into parts through dissociation rather than a whole that is constructed through the association of parts. This has several consequences: first of all, it rules out mechanism as a complete account of life because the focus on ultimate parts means it cannot think life except as constructed from matter; and secondly, it rules out vitalism as an account of life because the focus on an immaterial life-force means it cannot think its relation to matter except as a mysterious kind of animation. We might say, then, that while mechanism lacks an adequate philosophy of life as a whole, vitalism lacks an adequate physics of particular living organisms.

In *Creative Evolution*, Bergson presents a third way of approaching the problem that avoids the dogmatic stand-off between mechanism and vitalism by providing an account of life in expanded material terms: as dissociation, as the freeing up of energy, as an unpredictable and ultimately *creative* evolution. Bergson eschews dogmatic theorizing and retains of mechanism and vitalism only what is based on experience: from mechanism, this is the analytic study of organisms (the forms of which now are understood as contingent rather than determined), and from vitalism, the idea of life (which is now understood as immanent rather than transcendent to the forms of organisms). In *Creative Evolution*, Bergson was working with an expanded understanding of matter that was not widely recognized at the time, and this, as well as his choice of the term *élan vital*, led to him being broadly categorized as a vitalist. Today, however, there are no longer the same mechanistic limitations on our understanding of matter, and Bergson's dynamic account finds corroboration in many areas of contemporary biology (although we can still, of course, find the same dogmatic mechanism that Bergson opposed). What we can also find is that in place of vitalism (which is now largely consigned to history) are a number of models for thinking life as an open, dynamic system and for thinking through the implications of this for scientific practice itself.

How, then, do we locate *Creative Evolution* in the context of biology today? We do not want to limit our treatment of *Creative Evolution* to its reinstatement in a revisionist history of biology that, in the light of recent alternatives, would seek to expand the story of twentieth-century biology beyond that of the

development of a mechanistic science leading from neo-Darwinism to modern genetics, but nor can we claim that *Creative Evolution* was a canonical text for the development of those alternatives. More than anything, it is the failure of the human genome project to "explain" life in mechanical terms (its greatest discovery was that there are not enough genes to do this, hence raising new questions rather than answering old ones) that necessitated a change of approach from determinism to a consideration of non-linear causality, feedback mechanisms, and context-dependent behavior.[59] What *Creative Evolution* can offer is a model for thinking through these kinds of problems in biology, and, what is more, a model that relates these problems in biological research practices both to a more general epistemology (an engagement with which runs through all Bergson's work, and *Creative Evolution* in particular) and to their broader social and historical context (something that Bergson develops in *The Two Sources of Morality and Religion*, particularly in its fourth and final chapter).

Biologist Steven Rose has stated the need for resources exactly like this in the preface to *Lifelines*, where he describes how his attempt to establish a perspective on biology that transcends genetic reductionism made it necessary to "draw upon those powerful alternative traditions in biology which have refused to be swept along by the ultra-Darwinist tide into accepting that living processes can be reduced to mere assemblages of molecules driven by the selfish urges of the genes to make copies of themselves."[60] For Rose, Bergson (along with Georges Cuvier, Étienne Geoffroy Saint-Hilaire, and Hans Dreisch) is part of "an alternative, almost underground non-reductionist tradition in biology [whose] voices were and still are drowned out by an almost universal reductionist consensus which insists that, whatever the theoretical critique, reductionism works."[61] And we should note here that Dreisch, Bergson, and others are no longer described as vitalists but as "non-reductionists," signifying an important shift in the intellectual landscape: we no longer have vitalism as a metaphysical hypothesis opposed to "scientific" mechanism, but non-reductionism as a valid position within science that is opposed to what is now recognized as the metaphysical hypothesis of reductionism.[62]

59. "The lesson that has emerged with blinding clarity from the whole genome project is the error of regarding an organism as a kind of supermolecular machine whose parts are written in the genetic code" (B. Goodwin, *Nature's Due: Healing Our Fragmented Culture* [Edinburgh: Floris Books, 2007], 89). "No amount of information on genes and protein interactions will ever add up to the complex, entangled whole that is the organism" (M.-W. Ho, "Human Genome: The Biggest Sell-Out in Human History," International Society for Science in Society report (2000). www.i-sis.org.uk/humangenome.php [accessed January 2010]).
60. S. Rose, *Lifelines: Life Beyond the Gene* (Oxford: Oxford University Press, 1997), xii.
61. *Ibid*., 78–9.
62. Indeed, in *Creative Evolution* Bergson had described the mechanistic treatment of life according to mathematical principles as "a certain new scholasticism that has grown up

The reductionistic or mechanistic focus on parts that Bergson criticized in neo-Darwinism is today most clearly evident in genetics, and is subjected to a similar criticism by a number of biologists. For example, Brian Goodwin writes:

> Organisms have been replaced by genes and their products as the basic elements of biological reality. … There is no lack of highly persuasive books whose objective is to demonstrate why organisms are not what they seem to be – integrated entities with lives and natures of their own – but complex molecular machines controlled by the genes carried within them. … It is the absence of any theory of organisms as distinctive entities in their own right, with a characteristic type of dynamic order and organization, that has resulted in their disappearance from the basic conceptual structure of modern biology.[63]

For Goodwin, evolution is not the realization of a genetic program, but a dynamic process of emergent order (morphogenesis) "in which genes play a significant but limited role."[64] It is an approach that, like Bergson's, reintegrates the quantifiable facts of scientific analysis in a broader appreciation of the qualitative process that is their true context. As Goodwin expresses it:

> in an extended view of the living process, the focus shifts from inheritance and natural selection to creative emergence as the central quality of the evolutionary process. … Inheritance and natural selection continue to play significant roles in this expanded biology, but

during the latter half of the nineteenth century around the physics of Galileo" (CE 236; cf. 13). Brian Goodwin also suggests that the modern science for which Galileo, Bacon, and Descartes laid the groundwork has now reached its limit as our primary way of knowing and relating to the world (*Nature's Due*, 11).

63. B. Goodwin, *How the Leopard Changed its Spots: The Evolution of Complexity* (London: Phoenix, 1994), ix–x. It is worth noting here that while Goodwin's statement might call to mind Richard Dawkins's *Selfish Gene,* Dawkins cannot straightforwardly be assimilated to a reductionist position. True, organisms are vehicles for the survival of atomistic genes in Dawkins's work, but only in the sense that it is the genes, and not the whole organism, that are the true subject of natural selection. In other respects, the organism is an "integrated and coherent" unit in which "genes may interact and even blend" in their effects on the organism. Dawkins's point as regards selection is that "they do not blend when it comes to being passed on to future generations" (*The Extended Phenotype* [Oxford: Oxford University Press, 1982], 114). While the reduction of inheritance to the passing on of genes is itself highly questionable, Dawkins does not reduce properties of organisms to the action of their genes, remaining sensitive to the environmental and social factors that affect gene expression.
64. Goodwin, *How the Leopard Changed its Spots*, xiii.

> they become parts of a more comprehensive dynamical theory of life which is focused on the dynamics of emergent processes.[65]

Denis Noble is another biologist whose work foregrounds the necessity of placing genes in their wider context. Whereas Goodwin uses a language of emergence derived from complexity theory, Noble develops what he calls "systems biology" as an alternative to the view that the instructions for the development of an organism lie in its genes: "there is no such program and there is no privileged level of causality in biological systems."[66] Noble denies any metaphors that would attribute causal agency exclusively to genes, as if they "control," "determine," "code for," or "contain" organic events in advance of their realization:

> From the systems biology viewpoint the genome is not understandable as "the book of life" until it is "read" through its "translation" into physiological function. My contention is that this functionality does not reside at the level of genes. It can't because, strictly speaking, the genes are "blind" to what they do, as indeed are proteins and higher structures such as cells, tissues and organs.[67]

> There is a complex interaction between genes and their environment – both the cellular environment and the wider environment of the organisms in which they exist. The organisms in turn have a relationship with their environment, and this also will have an impact on gene expression.[68]

> Moreover, this environment crucially determines which genes are expressed and to what degree. The passage of information is not simply one way, from genes to function. There is two-way interaction.[69]

However, despite the theoretical sophistication of the non-reductionist thinking of life, the shift toward this perspective within biology remains a mere stirring when compared to the landslide that its interpretive success might

65. *Ibid.*
66. D. Noble, *The Music of Life: Biology Beyond the Genome* (Oxford: Oxford University Press, 2006), xii
67. *Ibid.*, 34. [535]
68. *Ibid.*, 33. Here and in the next extract, Noble is specifically referring to the cellular environment, although in his view, what he says is also true of wider environments.
69. *Ibid.*, 35.

lead us to expect.[70] To understand why this is the case let us highlight another important point in the passage we cited from Rose: *whatever the theoretical critique, reductionism works*.

Who cares if the behavior of a gene is context dependent if we can isolate that context and show that within it the gene behaves in a predictable way? Or if we can isolate the aspects of a gene that are independent of a particular context and on this basis predict how it will behave when transplanted to a different one? Who cares about context dependence *in principle* when we can ignore it *in fact*? Well, philosophers such as Bergson do, and biologists such as Rose, Goodwin, Ho, and Noble do. But why do they? And what practical alternatives do they offer to the genetic technologies we are alluding to?[71] In order to answer this, let us turn Rose's statement that "reductionism works" into a question, or rather a series of questions: *how does reductionism work, what does it work on, and with what results*?

In their critical assessment of mechanistic practices in science, writers such as Rose, Goodwin, Noble, and Ho raise many of the same points as Bergson, emphasizing the utilitarian bent of the intellect toward fabrication, the historical contingency of scientific methods and principles, and the way mechanistic approaches actualize only a small part of a potentially far richer relationship to nature. However, they also emphasize two key issues that have developed only since Bergson's time: that research projects today are largely dictated by the requirements of technological and corporate interests, and that scientific practices constitute a significant intervention into natural processes – so much so that they are considered to make a significant contribution to the current environmental crisis. Now, in the terms of the mechanistic hypothesis, the intellectual reduction of nature to its fundamental parts is a process of discovery; but from a critical perspective, such an activity is not one of discovery but of intervention. If nature is a holistic process, then the isolation and manipulation of certain natural processes constitute a fundamental alteration of nature itself.

In *Creative Evolution*, Bergson's account of life as an integral whole was accompanied by an extensive critique of the intellect as that which resolves life into parts, describing it as an instrument of useful action rather than of disinterested speculation. Its main characteristic is the fabrication of instruments from matter, and when it turns to consider life it cannot help but do so from its

70. Both Goodwin and Noble, for example, have demonstrated the value of emergence and nonlinear causality as strategies for understanding the heart organ. See Goodwin, *Nature's Due*, ch. 2, in which he also discusses cancer as an emergent property of cells, and Noble, *The Music of Life*, ch. 5.

71. The word alternative is not entirely appropriate here; the issue is not about abandoning mechanistic science, but delimiting for it an appropriate field of application and complementing its method with others that may be more appropriate to different areas.

utilitarian perspective: "it makes us consider every actual form of things, even the form of natural things, as artificial and provisional; it makes our thought efface from the object perceived, even though organized and living, the lines that outwardly mark its inward structure" (CE 101). This ability to regard living form as provisional – to literally see in life only raw material for our use – gives us "an unlimited power of decomposing according to any law and of recomposing into any system" (CE 101). In *Creative Evolution*, this remains an epistemological point, and Bergson is primarily concerned with accounting for the "bewilderment" of an intellect designed to organize matter "when it turns to the living and is confronted with organization" itself, but the problem today is a different one: the "recompositions" that the intellect organizes are at odds with the "inward structure" or "organization" of organisms or ecosystems, and actually disrupts those systems (CE 104).[72]

Goodwin has demonstrated very clearly that the presuppositions of genetic reductionism "make it legitimate to shunt genes around from any one species to any other species."[73] If the gene is ultimately the only biological reality, then "species don't have natures" and "we can manipulate them in any way."[74] Life itself loses all significance in such a view, and nature becomes "a set of parts, commodities that can be shifted around."[75] As Goodwin notes, the rhetoric that goes along with biotechnology is totally at variance with the reality: genes are not stable bits of information, they are defined by context, and if you change the context you change the activity of the gene, leading to unexpected modifications and transgenic transference between species.[76] For Goodwin, contemporary genetic technologies mark the highest point of a "science of quantities" that was formally introduced by Galileo and has, during its relatively short history, enabled an exceptional rate of technological development. He suggests that the advancement of scientific knowledge, which now suggests that life is not made up of parts, and the worsening environmental crisis, which results from treating life as if it is made up of parts, both indicate the necessity of a fundamental shift toward what he calls "a science of qualities" that would take into account the

72. In *The Two Sources of Morality and Religion*, Bergson suggests that "the spirit of invention has not always operated in the best interests of humanity" and that we should "allot to the machine its proper place, I mean the place where it can best serve humanity," although his beef is largely with the social implications of technology, which fosters an artificial need for luxury and widens the gap between capital and labor, rather than with the environmental implications that would be revealed only years later. See Bergson, *The Two Sources of Morality and Religion*, 305–7.
73. B. Goodwin, with David King, "An Interview with Professor Brian Goodwin," *GenEthics News* **11** (March–April 1996), 6–8. **[536]**
74. *Ibid.* **[537]**
75. *Ibid.* **[538]**
76. *Ibid.*

properties of living systems as a whole.[77] In his most recent work he has argued that living systems have qualities such as health that are in no sense "secondary" to those usually observed by science. They are properties that pertain to the whole system and cannot be explained in terms of the properties or interaction of its parts.[78]

In the *Origin of Species* Darwin introduced his new concept of natural selection by using an analogy between variation under domestication and variation under nature. The work of contemporary biologists, no less than that of Bergson, suggests that it is time to move beyond this analogy. The effects of the contemporary techno-scientific "domestication" of nature are so much more powerful than the selective breeding that Darwin considered that they defy comparison (after Bergson, we could say that this is a difference of degree that is so great it amounts to a difference in kind). Rather than suggesting an analogy with nature, the evidence today indicates that "domestication" suggests the opposite: the technological manipulation and control of nature is the most short-sighted and destructive line of action we could have taken, disrupting nature and inhibiting creative evolution. Alongside her laboratory practice, Ho has also developed an extensive critique of mechanism, characterizing it as an adolescent phase in the development of the life sciences and claiming that the application of methods and principles drawn from the mathematical and physical sciences is inadequate to an understanding of life: in order to reach maturity, biology must adopt a more holistic perspective, using an intuitive as well as intellectual approach. She emphasizes a view of life as symbiotic with humans as participants in a creative – we could say, a *healthy* – evolution. Such participation cannot be grounded in an intellectual – that is to say, an *instrumental* – disposition toward nature: a disposition that makes us alienated from nature and from ourselves.[79]

Life is holistic, and the manipulation of parts has effects on that whole that cannot, in principle, be predicted in advance. Reductionists may well object that, given a complete knowledge of the parts, prediction is possible, but what Bergson originally revealed was that analytic knowledge alone is by definition inadequate, because it reveals not what life is, but only what we can do to it. In

77. See B. Goodwin, "From Control to Participation via a Science of Qualities" (1999), at http://www.schumachercollege.org.uk/learning-resources/from-control-to-participation-via-a-science-of-qualities (accessed January 2010).

78. See Goodwin, *Nature's Due*, ch. 3. Another example of reductionism at work on a larger scale is the industrial farming practice of monoculture: "This monoculture mentality arises directly out of a reductionist science of quantities that looks at species in terms of specific traits that can be maximized to give high yields of particular products" (Goodwin, *How the Leopard Changed its Spots*, 211). The Bergson scholar and environmentalist Pete Gunter also investigates the effects of monocultural farming in North Texas in his book *The Big Thicket*.

79. This is a central theme of Goodwin's *Nature's Due*.

this context, a concept such as "conservation" can find a new application, no longer as simply the preservation of life as it is, but rather as the preservation of the dynamism of life so that it can continue to evolve creatively. As the Bergson scholar and environmentalist Pete Gunter has pointed out, Bergson's focus on the whole of evolution "locates man squarely *in* nature and stresses man's kinship to all living creatures."[80] Bergson's model of evolution as the differentiation of a common impetus clearly emphasizes the importance of studying the evolution of ecosystems as well as individual species. The concept of divergent tendencies within a single evolutionary process means that all evolution, in principle, is symbiotic, and places ecology at the very heart of biology.

A biology of organisms that is not complemented by an ecology of the whole context within which they evolve is incapable of supporting an adequate concept of creative participation in life, leaving the scientist unable to comprehend life, able only to make use of it. Farming practices based on genetic technologies such as the annual use of neutered and patented seeds, or based on industrial technologies such as clearcutting and monoculture, effectively abolish the dynamic conditions of a creative evolution. Indeed, when Goodwin describes the way in which "mechanism works," he uses an analogy with drug addiction: "farmers become enslaved to 'scientific' methods of production that are intrinsically unsustainable, and new technological 'fixes' are needed to sort out new problems."[81] We cannot solve the problems that techno-science has created through further interventions. Indeed, this line of thinking has more in common with indigenous knowledge than it does with European epistemology, but it is important to note (as against readings that would suggest Bergson is an "irrationalist" and "anti-science") that this is not essentially at odds with science – only with the intellectual and industrial appropriation of science. What is required is – in Bergson's terms as well as those of contemporary biologists – intuition of the self and sympathy with life; only in this way can "humanity … set about simplifying its existence with as much frenzy as it devoted to complicating it."[82]

Creative Evolution is only now receiving the attention it deserves. More than any other work in the philosophy of life, this text is predominantly understood in light of what came after it. This is not to say merely that we interpret it in retrospect, but that the philosophical community has had a century to acclimatize itself to the scientific worldview that Bergson recognized at its inception. It stands as a lesson in how philosophy can accompany rather than follow science, and how both disciplines gain from this partnership. Dynamic

80. P. A. Y. Gunter, "Bergson and the War against Nature," in *The New Bergson*, J. Mullarkey (ed.) (Manchester: Manchester University Press, 1999), 168.
81. Goodwin, *How the Leopard Changed its Spots*, 210.
82. Bergson, *The Two Sources of Morality and Religion*, 307.

theories of biology and evolution can operate only through the recognition of the temporal character of living systems, ecological theories can operate only through the recognition of sympathy between organisms, and both these approaches were developed by Bergson at a time when biological science on the whole operated by treating organisms as raw material. Our thinking of life today is moving away from control and toward participation, away from exploitation and toward sustainability, and only now is scientific thought embarking on the path that Bergson pointed out a century ago, a path that he had seen indicated in the evolutionary biology of the late nineteenth and early twentieth centuries. Bergson's visionary ideas are not of course the only resource for this project,[83] but they surely merit being placed at the center of any serious philosophical response to questions of life and evolution.

83. Mention should be made of Uexküll's *Umwelt* research, which sought to show the extent to which the "environment" is structured and mediated by the specific *Umwelt* of the organism and which has been taken up by continental philosophers such as Heidegger (*The Fundamental Concepts of Metaphysicse*), Merleau-Ponty (*In Praise of Philosophy and Other Essays*), and Deleuze & Guattari (*A Thousand Plateaus*).