

What animals do – and the third way of evolution

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Over four decades Mae-Wan Ho was a persistent, courageous and outspoken critic of much of contemporary biological science, including the standard neo-darwinian “Modern Synthesis” theory of evolution.



The Modern Synthesis is still dominant, but less so – not least due to the rising tide of criticisms and reformulations arising from physics, cell biology, physiology, developmental biology, niche construction theory and other approaches to understanding life and its processes, now conveniently brought together under the so-called Third Way of Evolution banner – which embraces many of Mae-Wan’s own contributions to the debate.

Liquid Crystalline Water, GMO's and Lamarckian Inheritance

EPIGENETICS



Q&A With Mae-Wan Ho

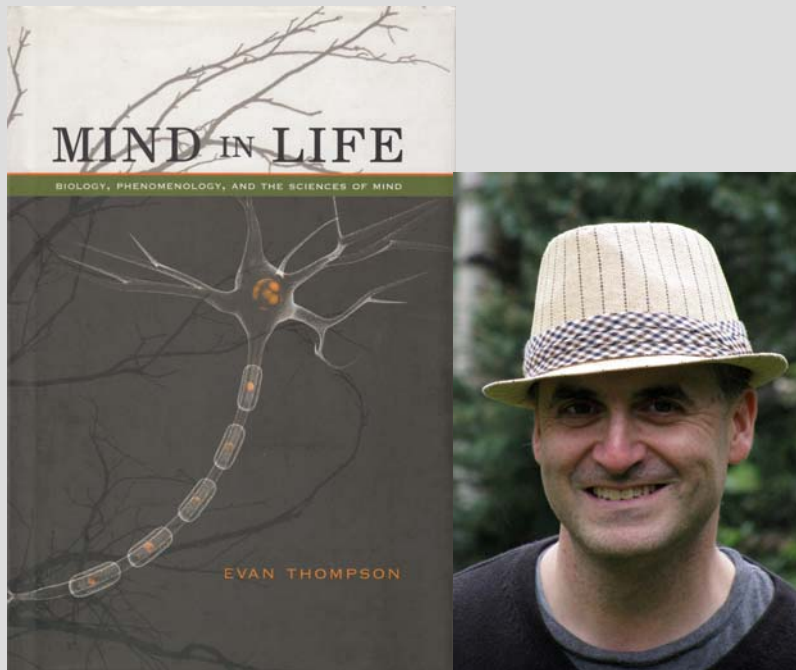
Mae-Wan's primary insights were derived from physics, cell biology, developmental biology and epigenetics – set within a holistic and anti-deterministic framework. My presentation will explore how many of the same insights can be identified from a holistic perspective that starts with the whole organism and its goal-directed behaviour.

Although long abhorred by most evolutionary biologists, an increasingly vocal group of scientists and philosophers now accept recourse to some form of teleological thinking – “interpretation in terms of purpose” – is essential if we are to take account of the manifestly ‘programmatically’ nature of living organisms.



“. . . a salmon swimming upstream suggests a degree of purpose inconsistent with a random inorganic process.”

James Lovelock. 1965. A physical basis for life detection experiments. *Nature* 207: 568–570.



... “teleology, in the sense of self-organized, intrinsic purposiveness, can be seen as a constitutive feature of the organism, on the basis of its autonomy and sense-making ...”
Evan Thompson 2007, p. 454

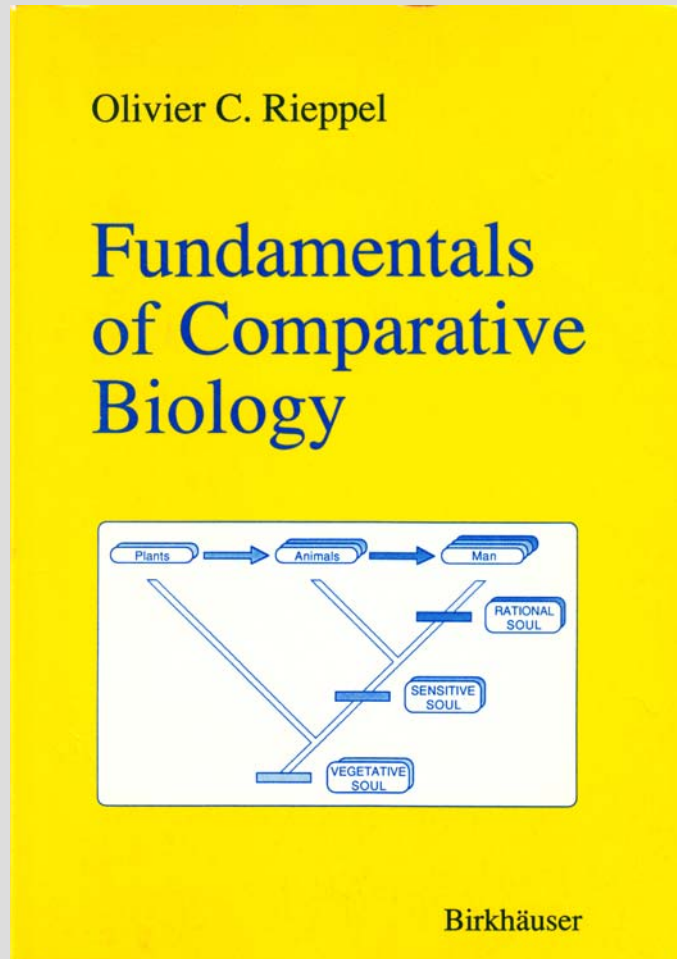
This thread, which runs from Immanuel Kant via the organic selectionists to contemporary writers such as Stuart Kauffman, Evan Thompson, Kalevi Kull and Peter Corning, highlights issues connected with teleology, teleonomy, self-organization, autopoiesis, agency, semiosis, autonomy, self-determination, reflexivity and creativity, all of which can be found or are immanent in Mae-Wan’s work.

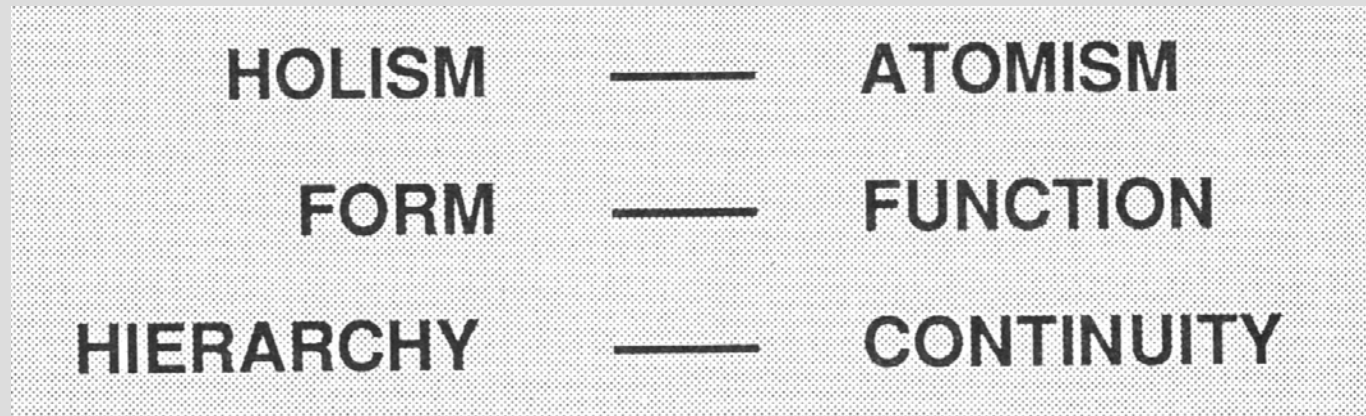
Kant is the effective starting point for this line of thought that sees organic evolution as something that cannot be understood on the basis of purely materialistic, *reductionist* explanations alone while, at the same time, does not require intervention of any supernatural agency.



Immanuel Kant
(1724–1804)

A word here on reductionism . . .





Modern appreciation of long-standing issues has focused on a series of controversial concepts which may be presented as three basic antitheses of comparative biology ... different philosophical premises and different methodological procedures result in alternative conceptualizations ... which are complementary to each other. The whole argument therefore is one for pluralism in modern biology.

Olivier Rieppel, 1988: page 3.



IRREDUCIBILITY
CONTINGENCY
INDETERMINACY
EMERGENCY
PROBABILITY
DISCONTINUITY
Quantum Mechanics
Matrix Mechanics
Heisenberg

REDUCIBILITY
CAUSALITY
DETERMINACY
PREDICTABILITY
CERTAINTY
LINEARITY
Classical Mechanics
Wave Mechanics
Schrödinger

Schrödinger *versus* Heisenberg:



CAT – Dead or Alive?

What do you think?

I don't know!

ISIS Lecture

Mae Wan Ho

Quantum Jazz

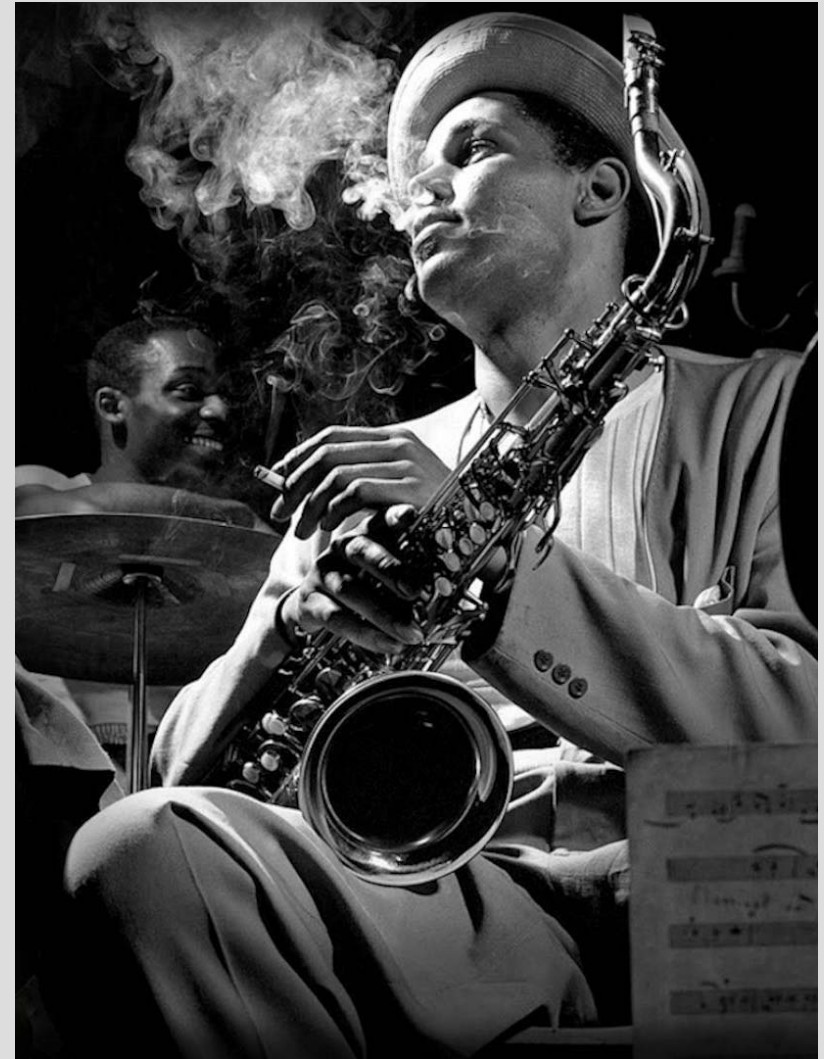
"The meaning of life, the universe and everything"

The music of the organism
dancing life into being

Weaving the colours of the rainbow

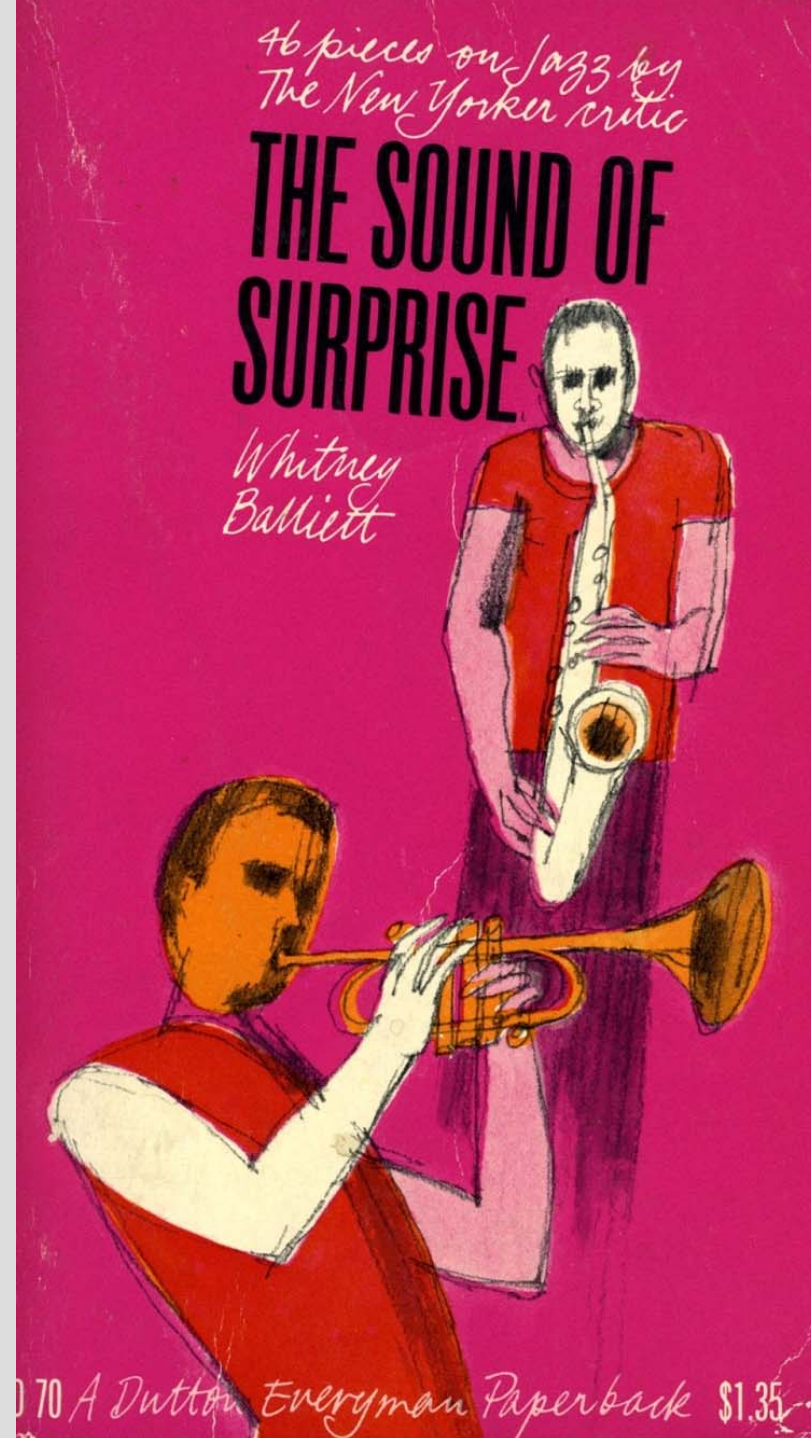
Catching each moment
in glad surprise

Peer



Jazz was once famously characterised as “the sound of surprise”. Improvisation creates emergent or unexpected musical combinations or effects – but these relatively ‘law-less’ elements are only ‘surprising’ because they are experienced in a context created by more ‘law-full’ or predictable musical elements – such as steady rhythms and pre-determined cyclical chord sequences. The two facets of the music are complementary, and both are arguably essential for a successful (creative, affective) performance.

Too often in science we seem to become wedded to a narrow and limited vision which attends to only one side of the ‘equation’.



It is my view that to understand the *origin* and *evolution* of living systems, we need to acknowledge both the processes of life, and the processes of evolution, and to explore the consequences that flow from making this distinction. Behaviour, in its broadest sense (“what animals do”), is both expression and mediator of organismic *agency* – or *purpose* – and must therefore play a key role in evolution.



Fisher, J. & Hinde, R.A. 1949. The opening of milk bottles by birds.
British Birds 42: 347 – 357, 2 pls

Amongst blue tits (but not e.g. European robins), this ‘discovery’ spread rapidly by learning from others, without time for any genetic change.

In other words, this is Peter Corning's idea of teleonomic selection. At the heart of Corning's particular thesis is the view that organisms are active partners in the process of evolution, leading to a progressive emancipation from the direct influences and limitations imposed by the environment – an idea put forward long ago by Whitehead.

Animals have progressively undertaken the task of adapting the environment to themselves.

Alfred North Whitehead. 1929. *The function of reason*. Princeton, NJ: Princeton University Press.



Alfred North Whitehead

Teleonomy

I am an agnostic – which, according to Richard Dawkins, means I am . . .

a boneless mediocrity simply flapping around in the middle



Richard Dawkins. 2006. *The God Delusion*. Bantam Press, London.

Worse still, I am a taxonomist – which places me in much the same bracket as accountants – people who, according to Monty Python, are:

. . . too boring to have an opinion about anything

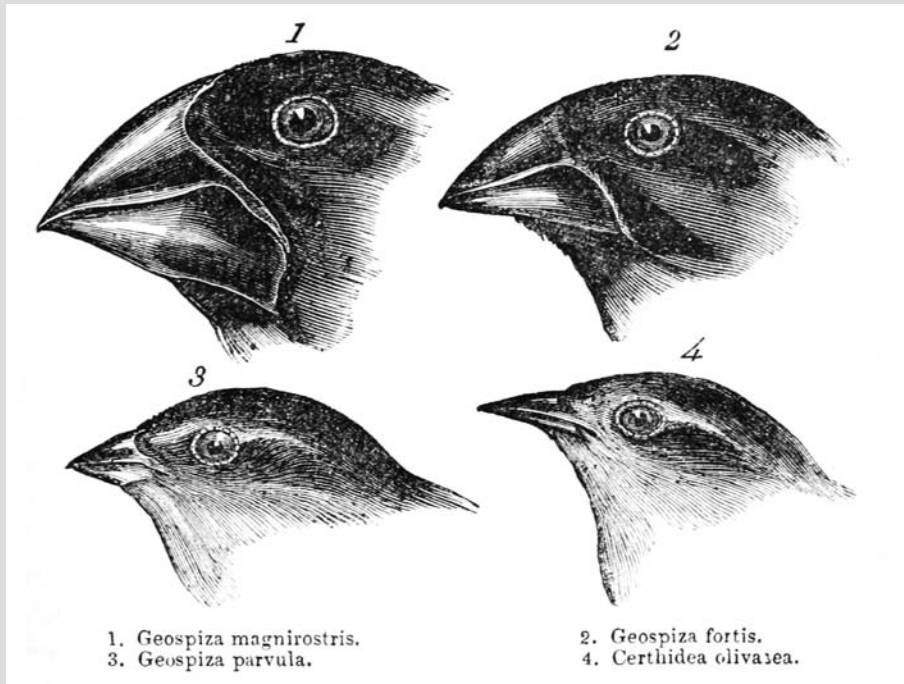
undeterred,
however . . .



Despite the seeming dominance of reductionism in the biological sciences throughout the 20th century, including the widely claimed rejection of teleological thinking, one particular type of teleology – teleonomy – has been a constant presence.

Teleonomy relates to particular systems that are driven by some endogenous, ‘local’ purpose. This is in contrast to teleology, which in this context is taken to refer to some exogenous, ultimate or ‘universal’ purpose – “the doctrine of the final causes of things”.

Thus teleonomy reflects the purpose-driven nature of living systems – with implications for the causal dynamics of evolution.

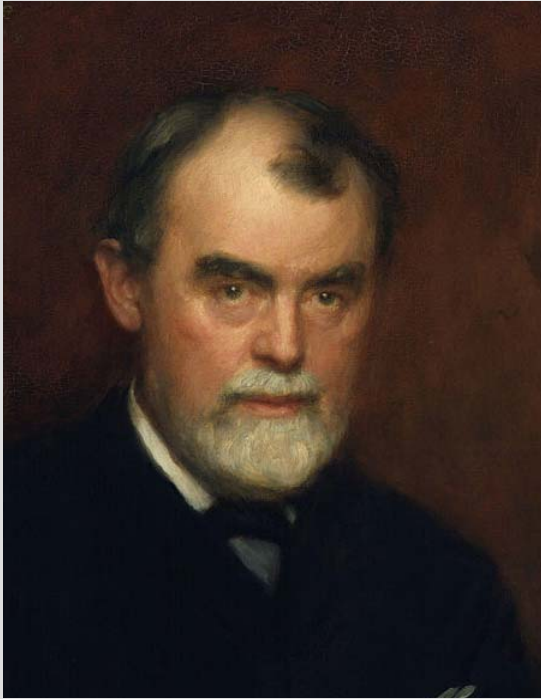


Adaptive radiation of “Darwin’s Finches” – which came first? – fortuitous mutations – or changes in (intelligent, ‘informed’) behaviour (as in the blue tits example) that then acted as a ‘sieve’ helping select later mutations and gene combinations which improved or fixed the initial, ‘plastic’ shifts?



An organized being [organism] is then not a mere machine, for that has merely *moving* power, but it possesses in itself *formative* power of a self-propagating kind which it communicates to its materials though they have it not of themselves. (Kant, in translation, 1790 (1951): 221)

Immanuel Kant. 1790 (1951). *Kritik der Urteilskraft* [Critique of judgment; 1951 edn, translated by Bernard JH]. New York, NY: Hafner Press (Simon & Schuster).



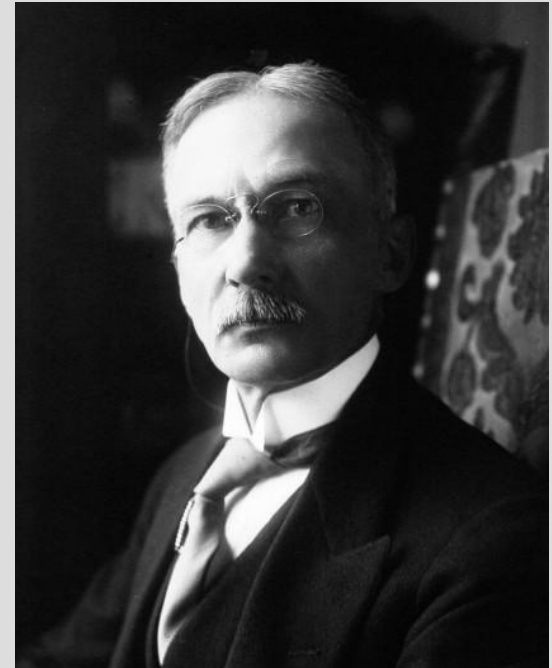
. . . the design which has designed organisms, has resided within, and been embodied in, the organisms themselves.

Samuel Butler. 1879. *Evolution, old and new; or, the theories of Buffon, Dr. Erasmus Darwin, and Lamarck, as compared with that of Mr. Charles Darwin*. London: Hardwicke and Bogue, p. 31.

Kalevi Kull. 2000. *Organisms can be proud to have been their own designers*. *Cybernetics and Human Knowing* 7: 45–55.



Organic selection is the term proposed by Professor Baldwin and adopted by Professor [Conwy Lloyd] Morgan and myself for this process . . . there would result an apparent but not real transmission of acquired characters. This hypothesis . . . while it abandons the transmission of acquired characters . . . places individual adaptation first, and fortuitous variations second, as Lamarckians have always contended, instead of placing survival conditions by fortuitous variations first and foremost, as selectionists have contended.



James Mark Baldwin – and his 'third way' of 'organic selection'

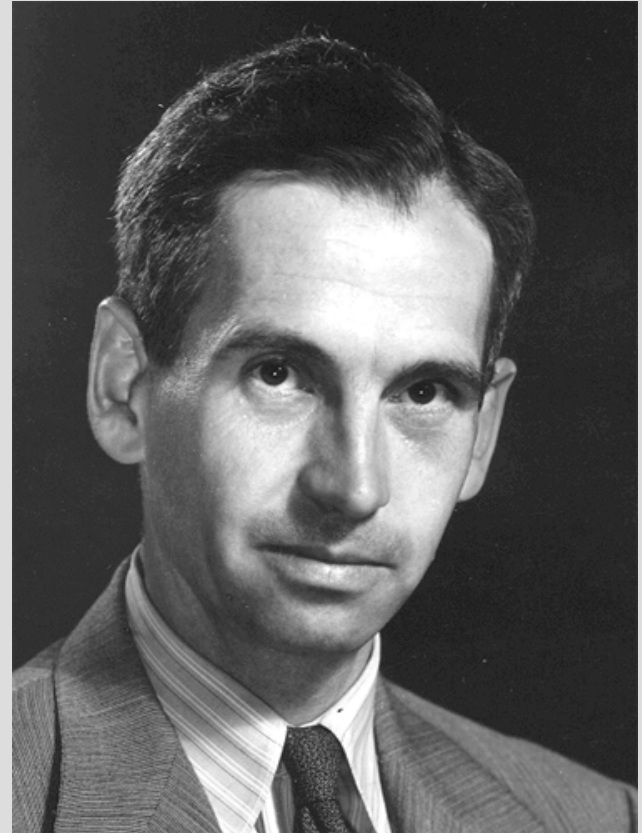
Henry Fairfield Osborn. 1897. Organic selection. *Science* (NS) 6: 583–587.



Purposefulness, or teleology, does not exist in nonliving nature . . . Living beings have an *internal*, or natural, teleology. Organisms, from the smallest bacterium to man, arise from similar organisms by ordered growth and development . . . On the assumption that all existing life is derived from one primordial ancestor, the internal teleology of an organism is the outcome of approximately three and a half billion years of organic evolution.

Theodosius Dobzhansky in Dobzhansky T, Ayala FJ, Stebbins GL, Valentine JW, eds. 1977. *Evolution*. San Francisco, CA: Freeman, 95–96.

‘A shift into a new niche or adaptive zone is, almost without exception, initiated by a change in behaviour’.



Ernst Mayr. 1963. *Animal species and evolution*. Cambridge, MA: Harvard University Press, 604.



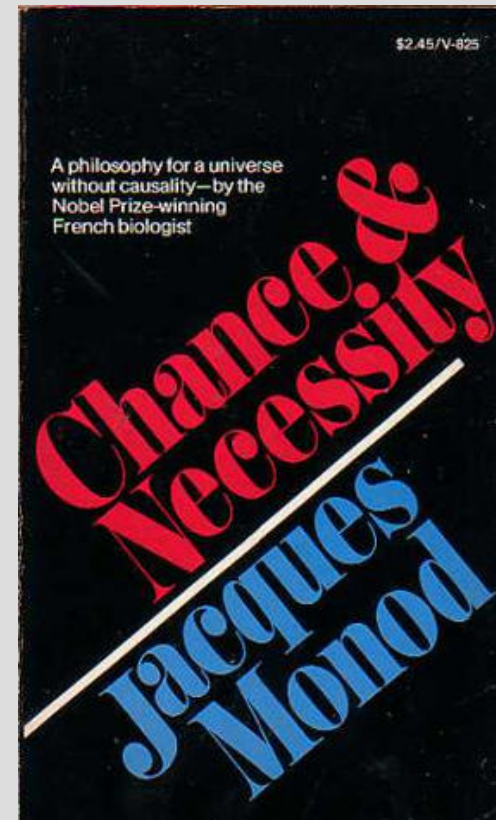
Jacques Monod, 1972

One of the fundamental characteristics common to all living beings without exception [is] that of being *objects endowed with a purpose or project*, which at the same time they show in their structure and execute through their performances [behaviour] . . . Rather than reject this idea (as certain biologists have tried to do) it must be recognised as essential to the very definition of living beings. We shall maintain that the latter are distinct from all other structures or systems present in the universe by this characteristic property, which we shall call *teleonomy**

*Teleonomy is a term first introduced in 1958, with more or less exactly the same meaning, by the Scottish physiologist Colin Pittendrigh.

The cornerstone of the scientific method is the postulate that nature is objective. In other words, the *systematic* denial that ‘true’ knowledge can be reached by interpreting phenomena in terms of final causes—that is to say, of ‘purpose’ ... Objectivity nevertheless obliges us to recognize the teleonomic character of living organisms, to admit that in their structure and performance they decide on and pursue a purpose. Here therefore, at least in appearance, lies a profound epistemological contradiction. In fact the central problem of biology lies with this very contradiction ...

Jacques Monod. 1972. *Chance and Necessity. An essay on the natural philosophy of modern biology* (English edition, translated by Austryn Wainhouse). London: Collins.



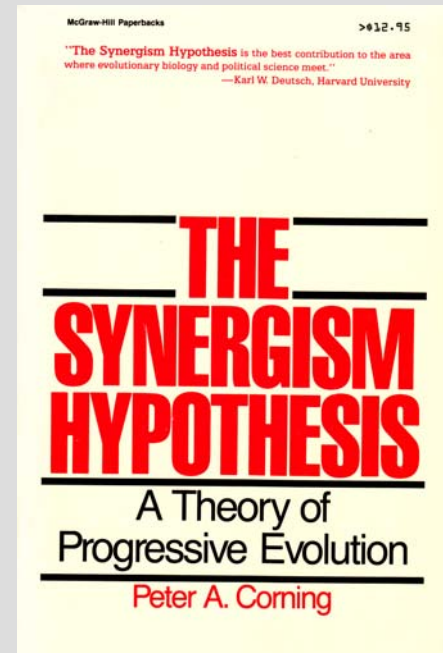
Haldane [in the 1930s] can be found remarking, '*Teleology is like a mistress to a biologist: he cannot live without her but he's unwilling to be seen with her in public.*' Today the mistress has become a lawfully wedded wife. Biologists no longer feel obligated to apologize for their use of teleological language; they flaunt it. The only concession which they make to its disreputable past is to rename it 'teleonomy'.

Philosopher David Hull (1982)

The more I think about the physical portion of the Schrödinger theory, the more repulsive I find it ... it's crap.

Werner Heisenberg to Wolfgang Pauli, 8th June 1926

In Peter Corning's *The Synergism Hypothesis* (1983) . . . “the role of behavioural influences in evolution was characterized as ‘Teleonomic Selection’, to highlight their purposive nature. Teleonomic Selection can be defined as: goal-related behavioural ‘choices’ among varying alternatives that may (or may not) have consequences for differential survival and reproduction, and the course of evolution over time. It refers to internally determined (cybernetic) behavioural innovations or changes that alter the relationship between an organism and its environment.”



Peter A Corning. 2014. Evolution 'on purpose': how behaviour has shaped the evolutionary process. *Biological Journal of the Linnean Society* 112: 242–260.

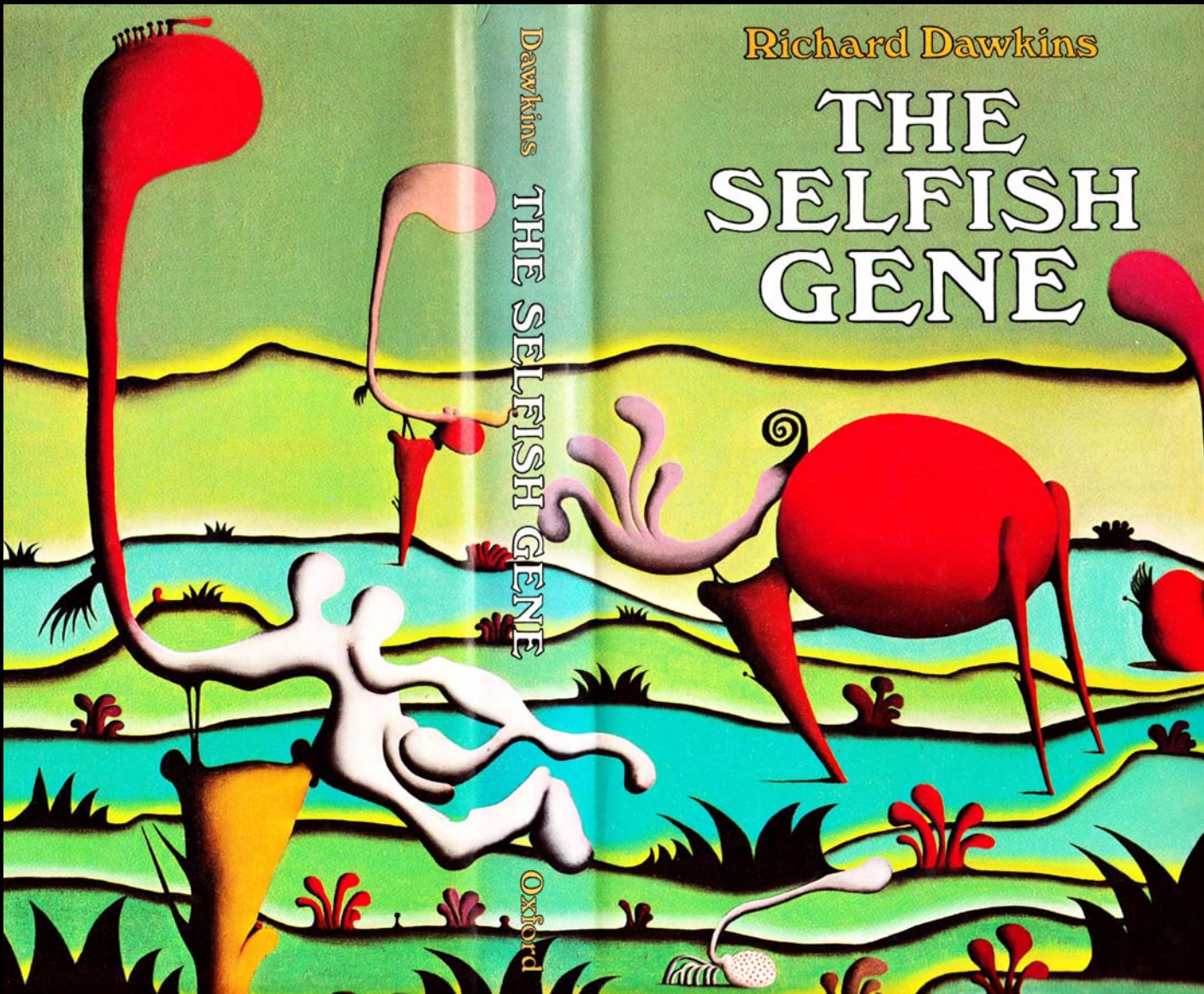


Stuart Kauffman (1995) expressed the view that biology took a definite and, in his view, wrong turn by embracing August Weismann's germline theory. This approach established the idea that ontogeny is under the control of a 'central determining agency', now seen as the 'developmental program' encoded by DNA – a vision of life resting entirely on 'genetic instructions'

The alternative view is offered by the reflexive relational ontology going back to Kant – the parts of an organism exist for but also by means of the whole, whereas equally the whole exists for and by means of its parts (Kauffman, 1995). According to this understanding, *the whole organism is the directive or determining agency* – it is autonomous.

Based on this approach, Kauffman questioned the ‘dogma of the central determining agency’, seeing it as non-essential to the ‘inalienable wholeness’ of life itself.

Stuart A. Kauffman. 1995. *At home in the universe. The search for laws of complexity.* Oxford: Oxford University Press.



Richard Dawkins

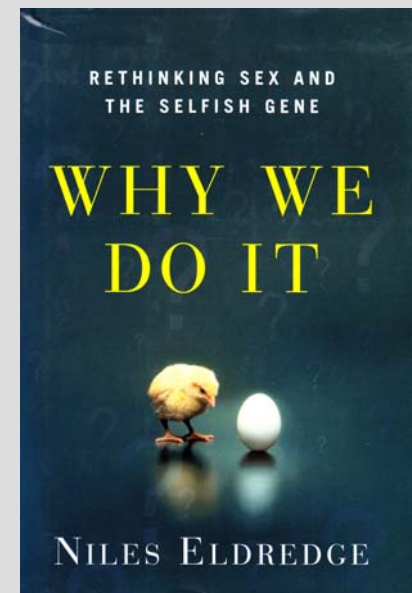
THE SELFISH GENE

1976

“We are survival machines—robot vehicles blindly programmed to preserve the selfish molecules known as genes” (Richard Dawkins, 1976: ix)

According to the popular press and television, *everything*, every bit of animal behaviour, really boils down to passing genes along to the next generation. Forgotten in the process is the simple fact that animals need to eat simply to live.

Niles Eldredge. 2004. *Why We Do It: rethinking sex and the selfish gene*. New York: Norton, page 16.



J. theor. Biol (1982) **99**, 357–375

**Are Individuals Really Subordinated to Genes?
A Theory of Living Entities**

ERKKI HAUKIOJA

*Laboratory of Ecological Zoology, Department of Biology,
University of Turku, SF-20500 Turku 50, Finland*

Erkki Haukioja. 1982. Are individuals really subordinated to genes? A theory of living entities. *Journal of Theoretical Biology* **99**: 357–375.



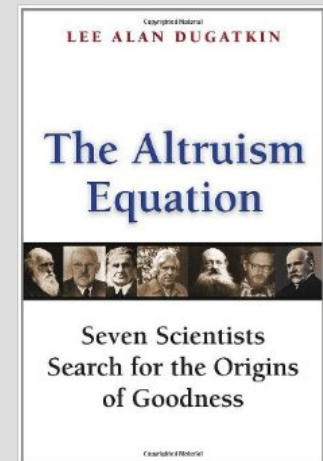
Kin selection and altruism

Haukioja drew strong conclusions from his insistence on a separation between the processes of living itself, and of evolution – casting logical doubt, for example, on the reality of kin selection. Thus genetic similarity does not reliably predict increased altruism towards offspring, whereas reproduction and altruism seen from the perspective of the process of living theory present no such difficulties (Haukioja, 1982: 366–369).

“Natural Being and a Coherent Society”

Mae-Wan Ho 1996

Attempts to explain altruism on a genetic basis rather than as fundamental due to the essentially cooperative nature of the process(es) of living became a ‘growth industry’ for late 20th Century biology. Was it an unnecessary distraction?

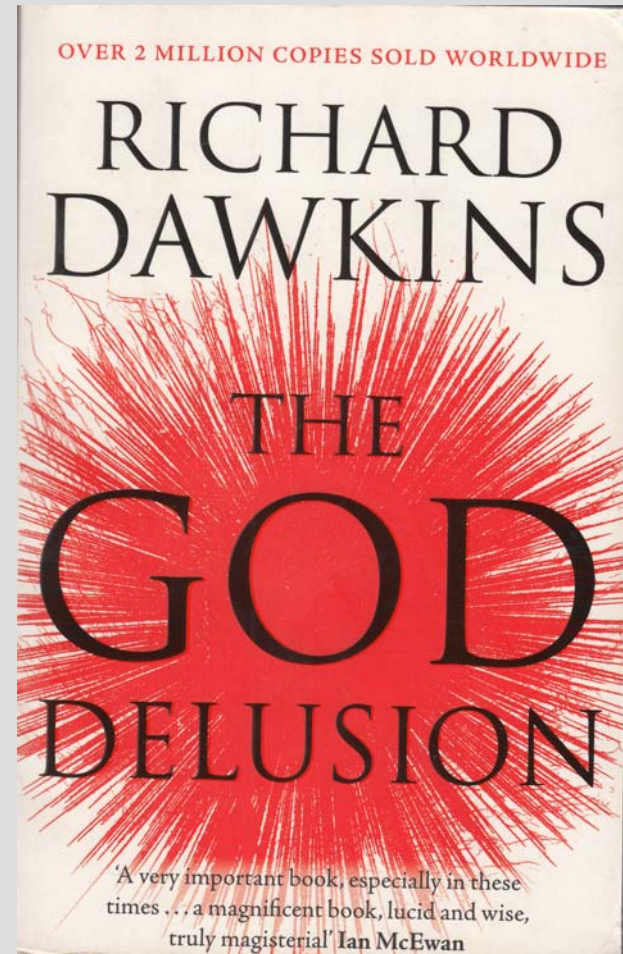
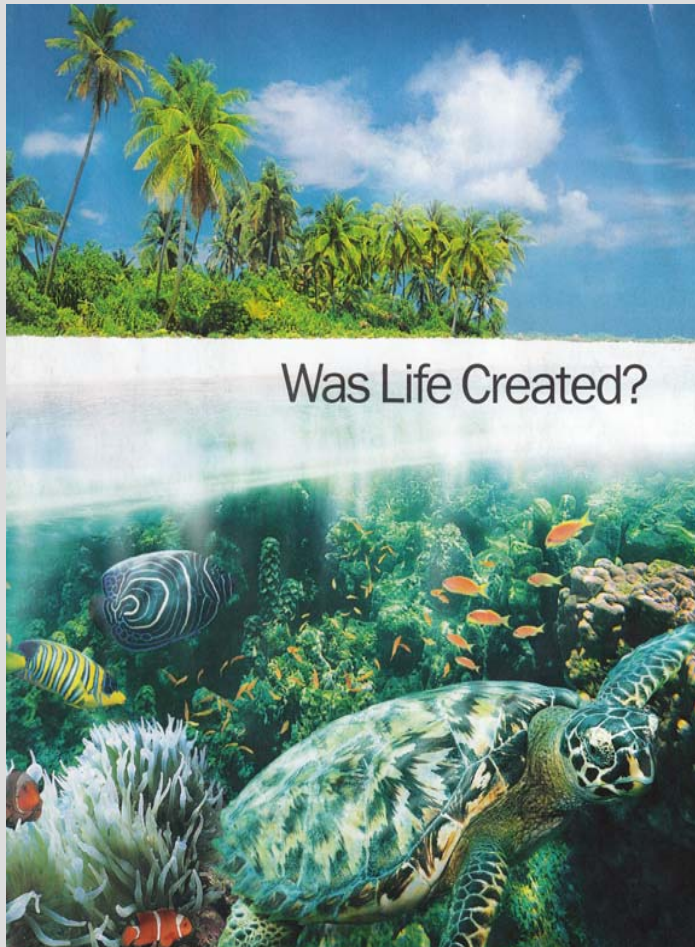


Selfish genes and teleology

Ironically, with respect to Hull's (1982) rejection of teleonomy based on population biology, Haukioja's 1982 analysis based on his 'process of living' theory demonstrated that, on the contrary, it is the selfish gene hypothesis that is teleological: "It means introducing teleology into biological theory if we believe that their [the genes] becoming frequent has taken place for the sake of trying to become frequent. It is the result not the cause." (Haukioja, 1982: 370)

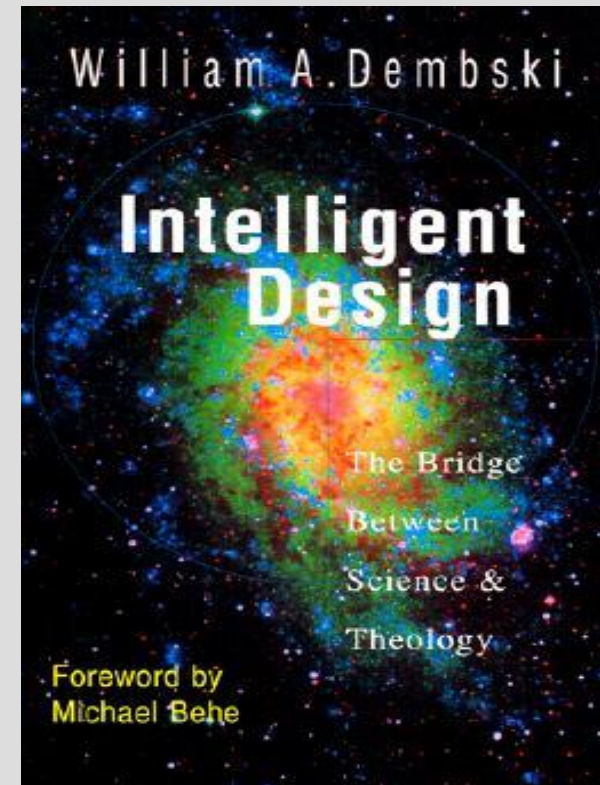


Two diametrically opposed views of life can literally be found “on the High Street” . . .



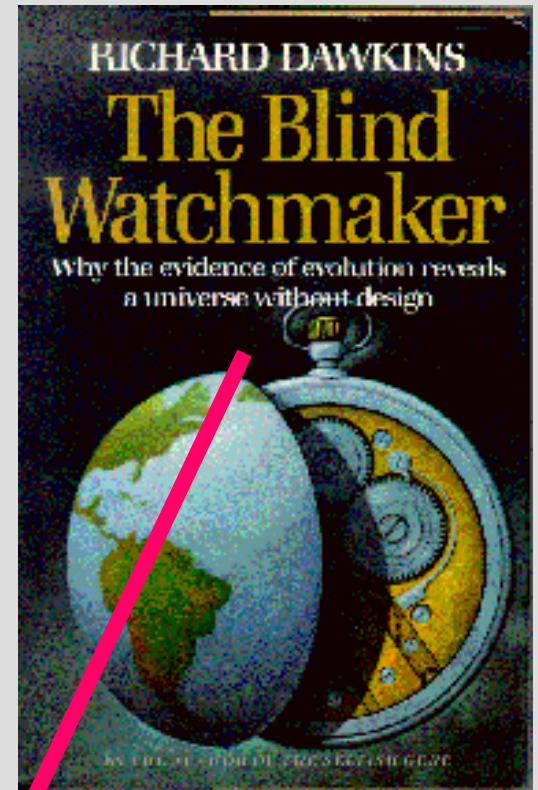
But once you have *life* (some system manifesting and able to maintain the processes of living), there are not just two but *three* basic ways in which *evolution* of this life (change, diversification) could occur:

(1) By divine intervention, whereby a divinity is responsible not only for the origin of life, but also acts subsequently to permit the evolution of “irreducibly complex” organs and organelles, such as eyes and flagelli, which supposedly could not possibly have evolved by selection acting on random changes. This would also be regarded as a teleological (not teleonomic) theory because such a divinity is usually presumed to have some ultimate end or goal ‘in mind’ for which change is necessary. Intelligent Design theory.



Dembski 1999

(2) By random changes in hereditary material on which natural selection can act, including normalising selection, disruptive selection, and directional selection. The first of these preserves the existing processes of life; the second and third can bring about adaptive (arguably progressive) change. No teleology (final causes) involved; driven by blind selection acting on physico-chemical systems. Neo-Darwinian theory in its most extreme form.



“Why the evidence of evolution reveals a universe without design”

Theories 1 and 2 are in stark opposition.

The *third way* involves an organisimic approach to adaptive evolutionary change that invokes teleonomy, but is not reliant on divine intervention – original or continuing -- or totally dependent on wholly random yet deterministic events.

Kull's bon-mot: “Organisms can be proud to have been their own designers.”

Denis Noble FRS – with James Shapiro & Raju Pookottil:

2014 Website: ***The Third Way***

<http://www.thethirdwayofevolution.com/people/view/denis-noble>

The vast majority of people believe that there are only two alternative ways to explain the origins of biological diversity. One way is Creationism The other way is Neo-Darwinism, which has elevated Natural Selection into a unique creative force that solves all the difficult evolutionary problems. Both views are inconsistent with significant bodies of empirical evidence and have evolved into hard-line ideologies. There is a need for a more open “third way” of discussing evolutionary change based on empirical observations.

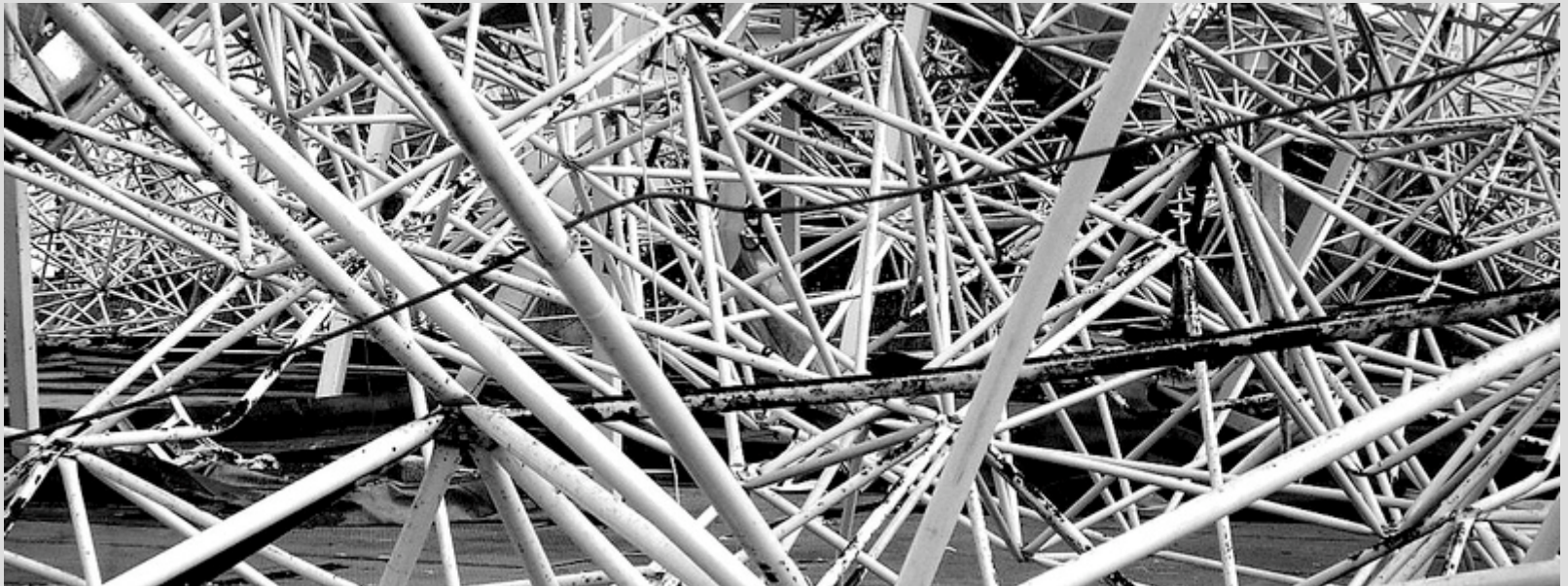


The *mechanist*, starting from the physico-chemical standpoint, interprets the living thing by analogy with a machine. The *vitalist*, on the other hand, supposes a guiding entelechy, which summons order out of chaos; he thus adopts a dualistic attitude. The elements of truth in both these views are recognized, and their opposition is resolved in the *organismal* approach to the living creature. This approach is conditioned by the belief that the vital co-ordination of structures and processes is not due to an alien entelechy, but is an integral part of the living system itself.

Agnes Arber. 1964. *The Mind and the Eye*.
Cambridge: Cambridge University Press, 100–101.

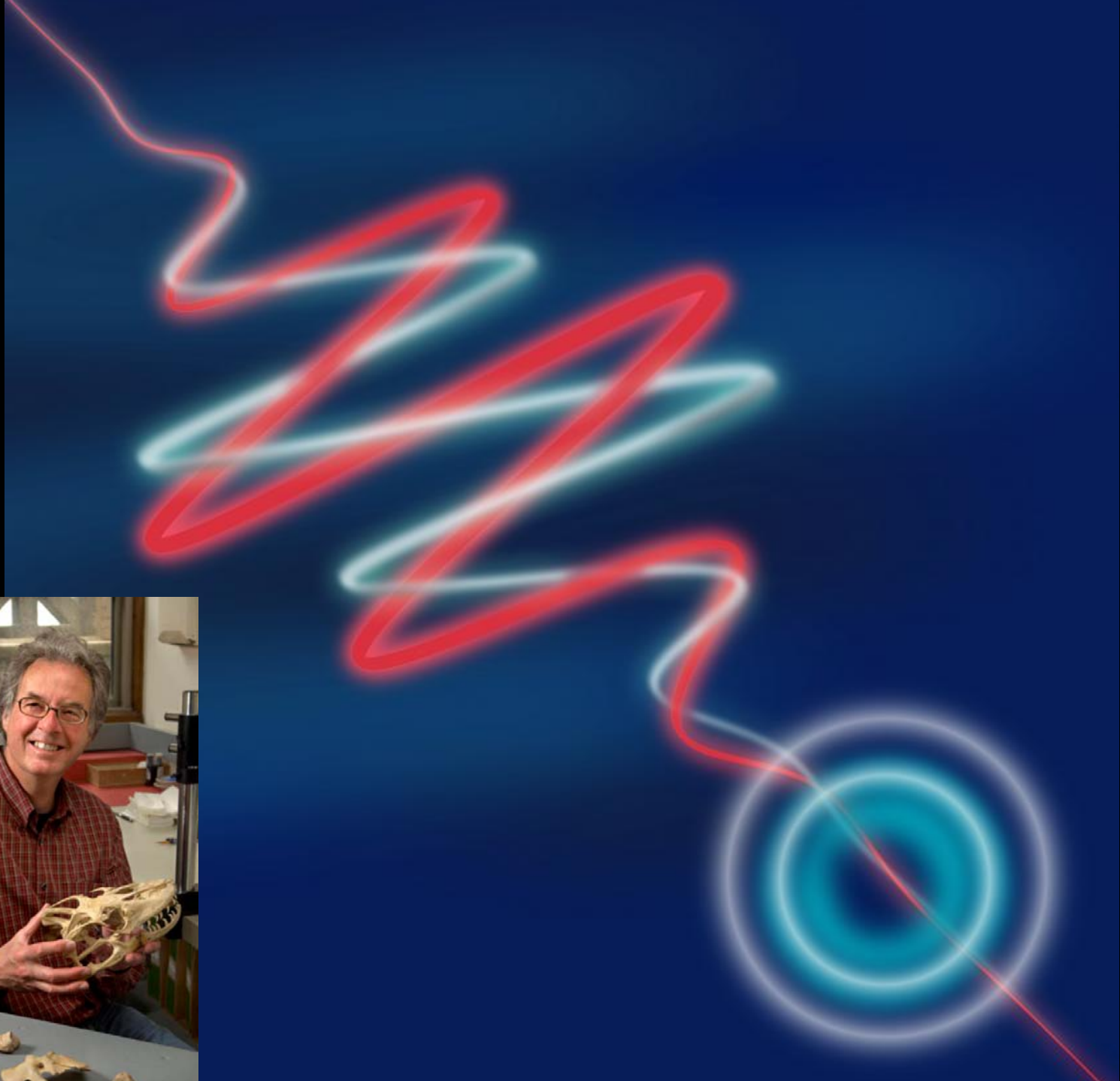


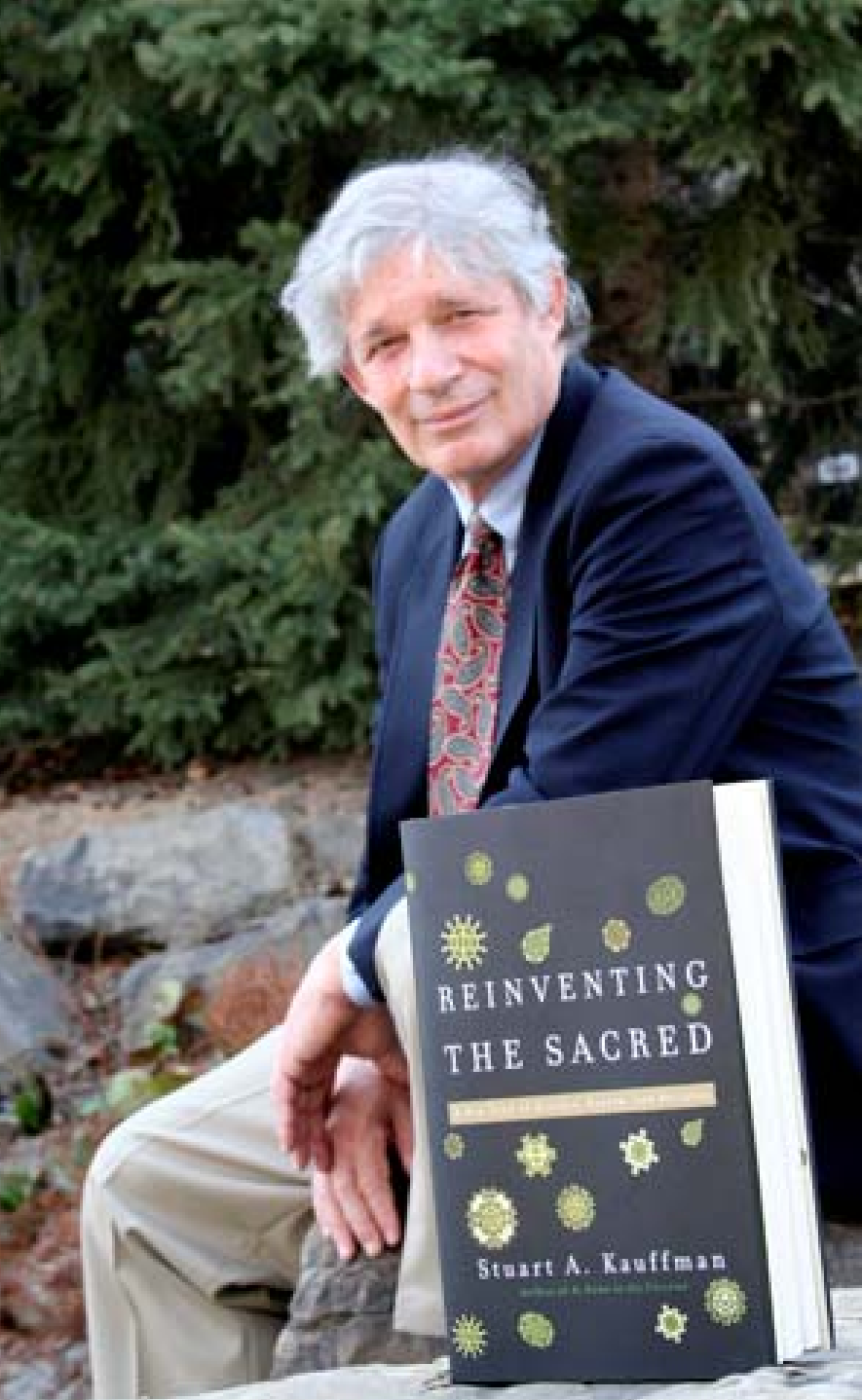
I believe it is now time to accept that organic evolution is a very complex phenomenon affected by processes operating at a variety of widely differing time scales, spatial scales and 'levels of organisation' that can, and do interact in various ways, and are subject to diverse constraints. What may be needed is something akin to what has been called "integral theory" . . .



“**Integral theory** is a school of philosophy that seeks to integrate all of human wisdom into a new, emergent worldview that is able to accommodate the gifts of all previous worldviews, including those which have been historically at odds: science and religion, eastern and western, and pre-modern, modern and post-modern.”

In a sense, the sort of thing that various physicists did to try to integrate matrix mechanics and wave mechanics in the face of wave-particle duality – a complementary type of approach writ large to deliver *Integral Evolution*: a pluralistic but critical worldview able and willing to embrace neo-Lamarckism, selectionism, mutationism, and reflexive Kantian self-organisation (‘autopoiesis’), all within a framework able to acknowledge the teleonomic purposiveness of organisms, and their individual agencies in maintaining the processes of life, and in driving the processes of evolution.





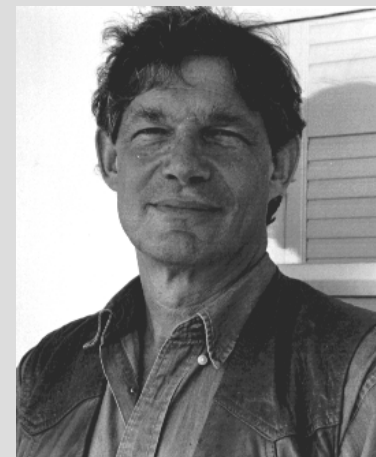
Craig Hamilton, IONS library, 2008:

The God Kauffman points to bears little or no resemblance to the God worshipped by the great traditions, let alone the God experienced by mystics throughout the ages. Where *that* God is concerned, Kauffman is right in step with his materialist brethren. He dismisses any notion of a transcendent, creative intelligence to be the naive, outmoded fantasy of a bygone age. For Kauffman, the God worthy of our awe is decidedly more down to earth. He suggests we turn our reverence toward not that which transcends space and time but toward a “natural God,” which he describes as “the creativity inherent in the physical universe.”

“If we reinvent the sacred to mean the wonder of the creativity in the universe, biosphere, human history, and culture, are we not inevitably invited to honor all of life and the planet that sustains it?”

Stuart Kauffman 2008 (2010) *Reinventing the Sacred*: 275–6.

[A more ‘uplifting’ view than that of Dawkins? Or more spineless agnosticism?]



Box 3.1 The mechanical and organic universes.

Mechanical Universe

Static, deterministic

Separate, absolute space and absolute time for all observers

Inert objects with simple locations in space and time

Linear, homogeneous space and time

Local causation

Given, non-participatory and hence, impotent observer

Organic Universe

Dynamic, evolving

space-time inseparable, contingent observer(process)-dependent space-time frames

Delocalized organisms with mutually entangled space-times

Nonlinear, heterogeneous, multidimensional space-times

Non-local causation

Creative, participatory; entanglement of observer **and** observed

Reflexive dualism / holism of living entities:

“... a reflexive logic according to which the unity of apperception was both cause and effect of itself, or, as Kant would put it in another context, **both author of and subject to its own laws**”



Jennifer Mensch, 2013. *Kant's Organicism*.
University of Chicago Press, page 12.

MAE-WAN HO



MEANING OF LIFE
& THE UNIVERSE

TRANSFORMING



In my essay “The Biology of Free Will” I show how, in liberating itself from mechanical determinism and mechanistic control, the organism becomes a sentient, coherent being that is free, from moment to moment, to explore and create its possible futures.

(2017, page 316)

to finish . . .

a short poem, two images, and a
quotation . . .

**Wanderer, your footsteps are
the road, and nothing more;
wanderer, there is no road,
the road is made by walking.**

translation of a poem by Antonio Machado



This poem and the following image were greatly appreciated by Varela, who with Humberto Maturana, refined Kant's idea to become the concept of 'autopoiesis'.

Francisco Varela
(1946–2001)

Chilean biologist,
neuroscientist
and philosopher.



M.C. Escher



Patrick Gries & Jean-Baptiste de Panafieu. 2011. *Evolution*. 7 Stories Press, New York.

Closing quotation

“How, then, are we to consider the evolution of life as this is generally formulated in biology? First, it has to be pointed out that the very word ‘evolution’ (whose literal meaning is ‘unrolling’) is too mechanistic in its conception to serve properly in this context. Rather ... we should say that various successive living forms unfold creatively. Later members are not completely derivable from what came earlier, through a process in which effect arises out of cause ... The law of this unfoldment cannot be properly understood without considering the immense multidimensional reality of which it is a projection”

David Bohm (1917–1992), physicist and philosopher,
quotation from;

Bohm, D. 1980, *Wholeness and the Implicate Order*,
Routledge & Kegan Paul, London, pp. 269 – 70.

