# DARWIN REVISIONED

**Brian Goodwin**

In celebration of the 150th anniversary of the publication of The Origin of Species, Brian Goodwin discusses the necessity of transforming Darwinian evolution into a liberating vision for the 21st century.

What Charles Darwin offered his contemporaries in 1859 with The Origin of Species was a view of evolution that was free of superstition and belief in a supernatural creator. His explanation of the emergence of the stunning diversity of species on Earth, through inherited variability in populations and competition among individuals leading to selection of superior variants, was regarded as an expression of natural law and the intrinsically creative power of the natural world.

Enlightened thinkers of the time experienced this to be powerfully liberating from dogma and ideology, refreshingly based on reliable evidence that came from detailed observation of species and their historical relationships. The theory was seen to be firmly based on scientific facts, and its many implications about human relations and society were considered to be reliably based on evidence.

We have now had 150 years to reflect on the origins of Darwin's insights and their influence on science and society. What I suggest is that some of the assumptions on which his ideas about evolution are founded have now become new superstitions and dogmas that are not enlightening, but enslaving and limiting. Science has moved on significantly since 1859 in recognising how theories reflect their historical context, and need to be continually re-evaluated – and Darwin's ideas are no exception. It is time to decide what is valuable in his theory and how it needs to be embedded in a broader vision that is liberating, not enslaving.

First, the good parts:
1. Nature is intrinsically creative and does not depend upon a separate divine being to generate the beautiful and varied range of life forms that have emerged during evolution.
2. Ecosystems are integrated wholes in which the subtle interactions between all the different species express a robust and resilient capacity for adaptation to changing circumstances.
3. There is a historical continuity of the living process throughout evolution that is based on inheritance of stable generative processes in organisms from one generation to the next.

Now the parts that need changing:
1. Evolution expresses progress that depends upon the competitive elimination of those species that are less successful in the struggle for existence.
2. This struggle arises from inevitable conditions of scarcity of food and suitable habitat for reproduction.
3. The separation of biological evolution from the physical evolution of the Earth.

The first two parts of Darwin's vision that need changing came from his understanding of cultural evolution and the progress that he believed depended on market capitalism as he saw it operating in Victorian England. This was based on economic principles defined by Adam Smith that assumed scarcity of goods among humans and competition for scarce resources. This was the foundation of the economic system of the British Empire, and Darwin believed that it was the basis of civilised progress in humans. Since he regarded human evolution as continuous with biological evolution, he put Nature and culture together in being shaped by natural selection through competition.

However, we now know that Nature works rather differently from this. Major steps in biological and social evolution arise as much if not more through co-operation, sharing among individuals, and symbiosis, as Lynn Margulis and Jane Goodall have persuasively shown. Furthermore, Nature is abundant in providing resources for living beings when they behave sensibly and do not destroy the ecosystems on which their lives depend.

The paradox here is that the economic system that we continue to use is based on destructive and wasteful principles, but it is regarded as virtually a law of Nature. This and the economic principle of continuous growth are now superstitions that we need to escape from or they will literally destroy us through their inherently destructive properties.

The third aspect of Darwin's theory that was wrong has now been corrected through James Lovelock's Gaia Theory, the living Earth that joins together evolution of biological species with the evolution of the whole Earth as a single dynamic entity. It is this that is giving us insight into just how destructive our economic behaviour is, with the opportunity of doing something about it by escaping from deadly economic superstitions that enslave most of the human world in debt and poverty. If we simply learn how Nature really manages the living Earth as an evolving whole, then we can escape from an outdated economy into freedom and abundance.

However, there is one more essential feature that needs to be added to transform Darwinian evolution into a liberating vision for the 21st century. Darwin accepted that science was about observation, measurement and quantities, assuming that qualities such as health, beauty and integrity were not part of the scientist's conceptual toolkit. This distinction is based on the separation of the so-called subjective realm of human experience from 'objective' study. Yet doctors recognise pain as real, and they evaluate health as much by assessing complexion, tone of voice, posture and general behaviour as by measuring blood pressure, blood cell counts, height and weight.

Quantities tell us about the properties of the parts; qualities tell us about the condition of the whole. They cannot be separated from our study of Nature without losing something essential. By eliminating qualities such as beauty, authenticity, happiness and love from the study of Nature and our relationship to it we have created a discipline that is very useful for technology, control and prediction but extremely bad at assessing the condition of complex wholes such as ecosystems, economies, societies, and their relationships.

What we need is a science of qualities and of quantities, in order to study both wholes and parts and their interdependence. This is holistic science. One of the people who developed a holistic view of science in the late 18th and early 19th centuries was Johann Wolfgang von Goethe, the great German poet, statesman and scientist. His vision of science was an integration of different ways of knowing that give us both quantities and analysis, as in conventional science, and qualities, which allow us to perceive wholeness and integration.

A science of qualities gives us an aesthetic and an ethical science that complements and completes our science of prediction and control. The result is a way of knowing the world that restores meaning in right relationship with the other members of our planetary society, and heals our fragmented culture to restore health and wellbeing to all. So let us honour Darwin for his insights into the intrinsic creativity and unity of Nature, but recognise that his ideas were limited and need to be embedded in the newly emerging broader vision of holistic meaning, aesthetic expression and responsible participation.

*(This article first appeared in Resurgence Magazine)*

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# Brian Goodwin

## Insightful biologist, philosopher & writer

Professor Brian Goodwin, the visionary biologist, mathematician, philosopher and teacher has died at the age of 78. Goodwin was a scientist of outstanding calibre who helped to articulate an intellectually coherent alternative to the neo-Darwinist notion that natural selection, acting on randomly mutating selfish replicators such as genes, is the fundamental process that drives evolution. As a philosopher and teacher, Goodwin in his

later years urged us to combine a deeply intuitive approach to nature with an open-ended rationality in service of sustainable living.

Goodwin's life-long dissatisfaction both with neo-Darwinist concepts and with our culture's unsustainable relationship with the natural world began when he was only eight or nine years old; he felt a deep sense of peace in the presence of large boulders in the extensive forests around his home in his native Eastern Canada. These experiences folded themselves deeply into his psyche and gave him a profound appreciation of the intrinsic creativity of the natural world, which, combined with his mother's rejection of patriarchy, would later provide him with the inspiration to question some of the most deeply held assumptions of our culture.

As a teenage schoolboy Goodwin excelled academically and, inspired by his reading of Marie Curie's biography, he felt that he must become a scientist in order to answer the central question that fascinated him then and throughout his long and distinguished career: what is life? While still at school, he was deeply impressed by the underlying principles that so beautifully explain why the chemical elements are ordered as they are in the periodic table, and at eighteen years of age, whilst studying biology at McGill University, he began to ask himself whether there might be equally powerful principles that could account for the awe-inspiring diversity of body forms in the living realm.

In his early twenties, he did a Master's degree in plant physiology at McGill, and even at this early stage in his scientific development he was unhappy with the neo-Darwinist interpretation of evolution. He felt that the coherence, self-organising power and creativity of organisms were seriously missing from this highly reductionist perspective, even though it was a powerfully unifying conception. He went on to a Rhodes scholarship at Oxford from 1954 to 1957, where he studied mathematics in order to further explore his feeling that there must be an intrinsic organising principle in the cosmos that expresses itself everywhere: in crystals, in the flows of fluids and in the forms of organisms.

Goodwin did his Ph.D. at Edinburgh University with Conrad Waddington, the eminent biologist who shared Goodwin's quest to integrate developmental biology with evolution. Goodwin's Ph.D. explored how cells are temporally organised in rhythmically coherent ways that lead to division and to the generation of different forms during development. This groundbreaking work later became the basis of Goodwin's first book, Temporal Organisation in Cells, which, with its highly mathematical emphasis on statistical mechanics and feedbacks involving genetic control loops, influenced other important scientists such as Stuart Kauffman in the US. Waddington, who also had strong interests in the arts and in the philosophical ideas of A N Whitehead, wanted to develop an educational process that went beyond science to include the transformation of human culture and politics. This radically integrative pedagogical approach greatly influenced Goodwin and surfaced in the last phase of his career when he joined Schumacher College.

In 1965, after a three-year post-doc at Massachusetts Institute of Technology, Goodwin was appointed to a Readership in biology at the University of Sussex. Encouraged by his Dean, the great evolutionary biologist John Maynard Smith, Goodwin explored the applicability of his biological ideas to the developmental dynamics of organisms such as Xenopus, the clawed toad.

A key collaborator in these experiments was Gerry Webster, with whom Goodwin wrote Form and Transformation: Generative and Relational Principles in Biology, which laid the foundations of the

structuralist movement in biology. The focus here was on how self-organising dynamics at the molecular and cellular levels give organisms their astonishing capacity to generate form with no need for natural selection, at least in the first instance. This emphasis on the wholeness of organisms drew him into debates with leading neo-Darwinists such as Richard Dawkins and Lewis Wolpert. It was during this period that Goodwin encountered Goethe's rigorously phenomenological approach to science. This taught him that it is possible to arrive at a correct conception of any natural phenomenon by dwelling with it closely and intimately, with one's intuitive and sensory faculties wide awake.

From 1984 until 1996 Goodwin was Professor of Biology at the Open University, along with Steven Rose. Here he continued his enquiry into the principles of organisation that could account for the forms of life. Together with L E H Trainor and C Brière, he made a highly influential mathematical model that elegantly simulated whorl formation in Acetabularia (a tiny unicellular marine alga shaped liked a miniature umbrella), by invoking the influences of calcium ions on the mechanical properties of the cell. Working with Ricard Sole and Octavio

Miramontes, Goodwin developed another mathematical model, this time showing how rhythmical activity emerges in a model ant colony when individually chaotic ants interact with each other at a specific density.

These and other models are described in his popular book ‘How the Leopard Changed its Spots’. During this period, Goodwin began a close association with the Santa Fe Institute, a centre of excellence for the study of complex systems. Here he was enthralled by the notion that organisms live at the "edge of chaos", where, in the words of his colleague Mae-Wan Ho, there is "maximum freedom to the individual with maximum coherence to the whole." Influenced by the Santa Fe Institute, Goodwin entered into a deep exploration of complexity theory, and with Sole wrote ‘Signs of Life’, which outlines how the mathematics of chaos and non-linear dynamics can be applied to the living world at all levels of organisation.

Through his friendships with Vandana Shiva, Teddy Goldsmith and many other activists, Goodwin had, over many years, become acutely aware of the ecological and social crises that the Western world's severe alienation from nature had created with the often inadvertent help of science. By the time Goodwin retired from the Open University, his search for the organising principles in biology had broadened into a deeper quest to heal this split between human culture and the rest of nature.

In 1996 he came to Schumacher College to give a talk, and soon after became a member of the resident faculty. In 1998, under his guidance, he and I started the world's first MSc in Holistic Science at Schumacher College, accredited by the University of Plymouth. Together with our students and guest-speakers such as Henri Bortoft, Craig Holdredge, Margaret Colquhoun, James Lovelock and Rupert Sheldrake, we developed a "science of qualities" which aims to help our culture shift its emphasis away from control towards participation with nature by healing the split between facts and values and quantities and qualities. One of these students is the mathematician Philip Franses, with whom Goodwin developed a model of the genome as a text riddled with ambiguity that can be read in a variety of ways by the rest of the cell as an active subject.

At Schumacher College (of which he was recently made a Founding Fellow), Goodwin's gentle nature and diverse insights at last found their full expression, to the benefit of the many people from around the world who encountered him here. He expressed these insights in his last book, ‘Nature's Due: Healing our Fragmented Culture’. In the ripeness of his later years his wisdom was prodigious. During his final hours, his sense of discovery undaunted, he gently lifted his hands in the air and declared to his nurse that he was "reaching for the stars".

*(This tribute first appeared in the Independent)*

***Stephan Harding***