

Darwin: Between God and Nature

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Introduction

The year 2009 is the two hundredth anniversary of the birth of Darwin. His iconic image gazes at us from old photographs giving the impression of a kindly sage, a little homely in appearance, and serene in his wisdom and knowledge. However, it is well-known that he struggled with ill health and suffered from anxiety relating to the social, political and religious implications of the new information revealed by his research. Charles Darwin embodied the tensions of his era.

This anniversary provides an opportunity to peer behind the icon and to explore some aspects of Darwin's life and his ideas. His thoughts form a pivotal point in the mighty flow of intellectual discovery that started in pre-Socratic ancient Greece and has accelerated since the Enlightenment to the present day.

The Natural Selection of Charles Darwin

When Charles Darwin died in April 1882 at Down House in Kent, he fully intended to be buried close by in the churchyard in the village of Downe, near his brother, some of his pre-deceased children and a few other relatives. That was not to be. A successful crusade began to have him placed in Westminster Abbey among the heroes of the nation. His funeral service occurred in St. Paul's Cathedral where Canon H. P. Liddon praised him for "the patience and care with which he had observed and registered minute single facts" and for bringing

about a revolution in modern thought and shedding "high distinction upon English science"¹.

When he was entombed in the Abbey, he was put beneath the monument to Isaac Newton, the man against whom all others were measured, and Darwin was not found wanting. It is fitting that they should be situated close to one another. Newton revealed and explained some of the laws of the Universe. Darwin examined life on Earth with meticulous care and showed that human beings, far from being godlike overseers, are an intimate part of the mass of life which is in a constant process of change through natural selection. It is ironic and an example of British political practicality that Darwin, an agnostic at the end of his life, was buried with pomp among the most revered of Christian symbols. But Darwin was popular with the British public for whom he symbolized British success in conquering nature and "civilizing the globe" under Queen Victoria's imperial gaze.

The gratitude displayed towards Darwin honored his theory of natural selection, a simple yet exceptional idea that he set out and supported with extensive scientific evidence. Natural selection is defined as "the process in nature resulting in the survival and perpetuation of only those forms of plant and animal life having certain favourable characteristics that best enable them to adapt to a specific environment."² Darwin noted that life never reproduces itself exactly and this subtle variation from one generation to the next is the force behind evolution. Like many great ideas, it seems obvious

once revealed. On reading *The Origin of Species*, the naturalist Thomas Huxley is reputed to have said: "How extremely stupid not to have thought of that!"³

Charles Darwin was born into the intellectual ferment that gave rise to the Industrial Revolution. His grandfather, Erasmus Darwin, was one of the leading British intellectuals in the eighteenth century and achieved distinction as a physician, naturalist, inventor, botanist, poet and philosopher. Erasmus Darwin was a free thinker and questioned the need for Christianity when one can sup "the milk of science."⁴ Erasmus rollicked in the libertinism of the eighteenth century. He sired twelve children by two wives and fathered a few on the side, meanwhile acquiring experience for his erotic poetry. He formulated one of the first formal theories on evolution in his book, *Zoonomia, or The Laws of Organic Life* (1794). He recognized the kinship of all creatures, elaborated on how life evolved from a common ancestor and worshipped in the temple of nature. For him, reason was divine and progress its prophet. Yet he believed in a distant Deity, a Potent-power, in the vast Unknown.

Charles Darwin's grandfather on his mother's side was Josiah Wedgwood, founder of the famous pottery company that bears his name. Wedgwood was in the forefront of industrial innovation, improved factory organization and refined the division of labour. The Wedgwoods were Unitarians whose tolerant beliefs have given shelter to progressive thinkers since the invention of the printing press and the Reformation. Unitarians considered God as one and denied the Holy Trinity of Father, Son and Holy Ghost, as there was little evidence for the Trinity in the Bible. Unitarians were receptive to the ideas of philosophical materialism which is defined as "the philosophical theory that regards matter and its motions as constituting the universe, and all phenomena, including those of the mind, are due to material agencies."⁵ Materialism is the oldest philosophical tradition in Western civilization and insists on the direct observation of nature and on explaining every-

thing that happens in the world in terms of the laws of nature.⁶

In nineteenth-century England, Unitarianism became the main link between enlightened dissent and the secular dissenters to the teachings of Christianity, and provided gathering places for those resisting the oppressive power of the Established Church. Unitarians were open to the findings of science and viewed the human future with optimism. Going a step beyond, Erasmus Darwin dismissed Unitarian beliefs as "a featherbed to catch a falling Christian."⁷ Nevertheless, Unitarian beliefs and philosophical materialism shaped the outlook of Charles Darwin.

His grandfathers were close friends and part of Birmingham's elite industrial circle, the Lunar Society, which comprised fourteen members including James Watt, whose improvements to the steam engine were fundamental to British industrial expansion. Erasmus Darwin's son, Robert, a successful doctor and astute investor, married Josiah Wedgwood's daughter, Susannah, and Charles was born from that union. In his turn, Charles Darwin married his first cousin, Emma Wedgwood.

Charles Darwin's entry into the world in 1809 was well-timed. Great Britain was on the verge of assuming scientific, economic and political leadership. The Darwins and Wedgwoods prospered and lived like squires. Surrounded by family estates, young Charles could exercise his curiosity about nature and he soon became an avid collector of shells, postal franks, birds' eggs and minerals. He did not distinguish himself at his first school, and his father rebuked him by saying that he would be a disgrace to his family, took him out of school two years early, and enrolled him in medicine at Edinburgh. In his first year, Charles read voraciously but did not enjoy his medical courses as he could not endure the sight of blood. He found other diversions. He attended a wide range of lectures and displayed an affinity for the subject of chemistry. He participated actively in a student group

called the Plinian Society, which, in 1826, counted many radicals as members, resulting in fiery debates. He enjoyed exploring the coastline with his brother, Eras, picking up cuttlefish, sea-mice and sea-slugs.

His most influential mentor in Edinburgh was Robert Edmond Grant, who had left medical practice to study marine life. Sixteen years older than Darwin, Grant was a freethinker who admitted no spiritual power behind nature. He was influenced by the theory of evolution

of Jean-Baptiste Lamarck, who had proposed that evolution was based on the inheritance of acquired characteristics whereby an animal passed on to its offspring physiological changes it had undergone during its own lifetime; for example, a blacksmith would pass on his work-strengthened muscles to his children. Lamarck believed that creation is in a constant state of advancement with humankind at the top of this chain of progression. Grant specialized in marine biology and invertebrate zoology, especially enjoying the study of microscopic life, and he harboured a burning zeal for science. Under his direction, Darwin filled

notebooks with observations of minute sea life. In such diversions, Darwin gained the training that would allow him to shape his own approach to evolution ten years later. Coincidentally, Grant admired *Zoonomia*, the book by Charles' grandfather and had cited the book in his doctoral thesis. He must have taken satisfaction in nurturing a grandson of Erasmus Darwin.

When Charles completed two years in Edinburgh, Robert Darwin was fully aware of

his son's indifference to the study of medicine. He enrolled him in Cambridge to train to become a parson in the Church of England, which was viewed by some as a safety-net to prevent second sons from becoming wastrels. Many country parsons were amateur scientists in the early decades of the nineteenth century. While Charles did well in his exams in theology at Cambridge, his passion was for the practice of "beetling," then in vogue, with students competing to collect the most beetles. Darwin extended the range of this pastime to include all insects.

Meanwhile Darwin kept abreast of recent developments in geology, and was inspired by the lectures of J. S. Henslow, Regius Professor of Botany, and by the scientist, John Herschel, who glimpsed the limitless scope for scientific explanation and the rapid expansion of knowledge.

Darwin's enthusiasm for science led to his participation on the voyage that was to change his life. In 1831, Captain Robert Fitzroy of HMS Beagle sought a gentleman naturalist to join the scientific and surveying expedition and to be a companion to the Captain during the long voyage of over five

years. Fitzroy was an aristocratic younger son and an accomplished surveyor. A companion of the right background would provide relief from the isolation of command which had resulted in the suicide of the captain of a similar expedition. A series of discreet inquiries led to Darwin who was expected to pay his own way. Clearly, his participation was made possible by his family's wealth and high social standing. His family paid 500 pounds sterling to cover the cost of his voyage and provided additional money during

***I cannot persuade
myself that a
beneficent and
omnipotent
God would have
designedly created
parasitic wasps
with the express
intention of their
feeding within the
living bodies of
Caterpillars.***

Charles Darwin

the trip to fund some of the field work. Darwin rose to the challenge. He kept a full record of the voyage in his diary (770 pages); filled 1383 large pages with his notes on geology, 368 pages on zoology, discovered new species, sent crates of bones and birds, rocks, and corals back to England. His master catalogue listed 1529 species in spirits and 3907 labelled skins, bones, and other dried specimens.⁸ He left England as a young man, and returned an established scientist, widely admired in his homeland.

After the voyage on HMS Beagle, Darwin's interest in nature had displaced the idea of a parsonage and he was determined to study nature for its own sake and to understand its powers and ways. This choice was facilitated by his private wealth. He could select his own pursuits and he chose to acquire a country estate in Kent where he turned his home into a laboratory.

By the late 1830s, Darwin has set out his seminal ideas on natural selection, with the writings of Thomas Malthus acting as a catalyst. Malthus calculated that the human population increased geometrically, and food production, arithmetically. He estimated that, free of natural constraints, population would double in twenty-five years but that shortages of food and other natural resources would keep the population in check. Malthus realized that scarcity subjected human societies to intense internal competition for access to resources essential for successful breeding. Up to that time, the prevailing thought was that human numbers were constrained because of competition among species, not within species. What Malthus viewed through the lens of an economist, Darwin applied more generally to nature and to other life forms. The best-adapted varieties survive to breed, expanding at the expense of the rest, leading to gradual change in species.

During the spring of 1844, Darwin elaborated his notes on transmutation, or evolution as it is now called, into a 189-page essay, but he refrained from publishing these ideas for fifteen years. The concept of the transmutation of spe-

cies was not considered respectable in the 1830s and early 1840s, and Darwin did not want to offend those of his friends who were conventional.

The historical context provides an explanation for this apprehension. The French Revolution of 1789 had induced a reaction towards social conservatism in Great Britain. Prior to the 1830s, the Established Churches of England and Scotland held sway over many aspects of life, the making of appointments to political offices, and to hospital, university and legal posts. They restricted civil liberties and suppressed other religious groups. The 1830s and 1840s brought much economic and political turmoil. The 1831 census showed that the population of Britain had doubled in the previous thirty years to twenty-four million. Those herded off the land to labour under dreadful conditions in new factories seethed with resentment. In 1830, a further revolution in France deposed the reactionary Charles X and emboldened some English radicals who called for a republic and avowed atheism. A serious economic recession occurred in the late 1830s, followed by the famines of the 1840s. As wealthy landowners, the Wedgwoods and Darwins abhorred the fierce radicals baying for a new order and Charles Darwin shared this distaste as his own original and momentous ideas grew within him. He feared that the ideas might be pounced upon by political radicals to support their calls for political transformation. He did not want to lose standing in the eyes of his social and scientific peers. When he did present his concepts, he wanted to ensure that they were backed by ample evidence, which he provided, for example, in his studies of barnacles and on the selective breeding of pigeons and farm animals.

Alfred Russel Wallace galvanized Darwin into writing *The Origin of Species*. In 1856, Wallace published an article on the introduction of species and followed up in 1858 with *On the Tendency of Varieties to Depart Indefinitely from the Original Type*, which shocked Darwin who felt that it could have been an abstract of his

paper on evolution written almost twenty years earlier. As with Darwin, a reading of Malthus had led Wallace to his insight on natural selection. Darwin may have contributed to Wallace's deductions since he had been in correspondence with Wallace for a few years and often tested some aspects of his ideas on other scientists. Nevertheless, it is a tribute to Darwin's honor that he proposed to Wallace that they publish jointly their initial findings on natural selection. They agreed on a joint paper which was presented at a meeting of the Linnean Society. It drew little reaction other than a stunned silence. Meanwhile, Darwin assembled overwhelming evidence of natural selection and prepared his original authoritative tome. The publication of *The Origin of Species* in 1859 changed the human perception of life on Earth.

Why was Charles Darwin successful in gaining acceptance for the concept of evolution? The idea had been around for decades. His own grandfather had proposed it in 1794, but without the important link of natural selection.

The rapid expansion of scientific knowledge beginning in the seventeenth century had called into question many aspects of the biblical view of Creation. For example, Charles Lyell's *Principles of Geology* (1830) argued that the Earth's crust had evolved gradually over a very long time by many small changes. Lyell's work impressed Darwin.

With its emphasis on competition, the theory of natural selection found support among the middle class who were calling for more competition, free trade, the expansion of factories and the removal of religious constraints. The Great Exhibition of 1851 in London had celebrated the dominance of British industry made possible by applied science. Industrialists understood the connection between new knowledge and economic leadership. Darwin's scientific research had won him international fame and contributed to British prestige and this had not gone unnoticed by political leaders.

Darwin's high scientific standing, his origin in the new industrial elite, and his family wealth made many receptive to his ideas, but his personal qualities, his political sensitivity, tact, humility, patience, perseverance, and strategic skills also contributed to his success. He was by nature placid, unpretentious, and amiable. His writing style conveys directness and integrity but also exudes the magisterial confidence of Great Britain in the mid Victorian era, a feeling that science would lead humankind to unparalleled levels of achievement. As his ideas developed, he did not make enemies needlessly by attacking others who held views different from his own. For his book on evolution, Darwin realized that only a technical treatise that piled on cumulative layers of evidence would convince the talented young scientists rising in the hierarchy of the Royal Society, the British national academy of science. He tested his ideas on other scientists to anticipate and address potential objections while not fully revealing his own hand. He nurtured the next generation of scientific lions, such as Joseph Dalton Hooker, botanist, explorer, and one of the founders of geographical botany, and Thomas Henry Huxley, biologist, who became a fervent advocate of Darwin's theory of evolution by addressing large audiences from all classes. He noted the growing acceptance of the idea of evolution in respectable circles in the 1840s and 1850s and prepared the ground carefully to time the publication of *The Origin of Species* in 1859. In so doing, he transformed biology from a set of random facts into a system of knowledge.

From Christianity to Agnosticism

The transition of Darwin from a Christian to an agnostic man of science is symbolic of the changes under way in British society in the nineteenth century. In the late 1820s, religion was not unpalatable to him when he trained at Cambridge to become a parson, although he had qualms about not being sufficiently moved by the Holy Spirit or by his religious studies. Darwin was a patient man and he allowed big ideas to ripen within him over time. He consid-

ered himself a Christian until the age of forty when he foundered on the moral logic of eternal punishment and could not condone the New Testament, the source of the appalling doctrine. The death of his ten-year-old daughter, Annie, extinguished any remnants of belief. He concluded that Christian faith was futile. This was an emotionally demanding change for a man whose beloved wife, Emma, was a believer and deeply concerned that Darwin's emerging views would prevent them from living happily together in an afterlife.

In England, at the time of Darwin's birth in 1809, there was a congenial truce between the traditional Christian perception of Creation and the views of most scientists. The Earth was ruled by a providential God in whose image human beings were created and the world was like an English country garden on a fine summer afternoon. Many scientists saw themselves as students of God's works. As Darwin developed his ideas on evolution, natural selection, and the descent of man, he knew he was straying from what was considered respectable. He felt that he was living a double life. The tensions grew within him. After his return from his voyage on HMS Beagle, Darwin suffered from an often debilitating nervous stomach that some have suggested may have been caused by a parasite picked up during his travels, but the length of his life belies that speculation. His wife Emma observed that Charles' general health was always affected by the health of his mind, and, as he developed his revolutionary ideas, his mind was in turmoil.⁹

Given the harshness of the Darwinian vision, however accurate, it is little wonder that religious believers countered vigorously and ceded ground only when overwhelmed by logic and facts. Through Darwin's eyes, Nature was a seething chaotic slum from which only a few would survive to create future generations. Nature was profligate, a mad inventor, all too ready to consign the weak, the unfit, the malformed to the heap of genetic discards. But Darwin noted that Nature drew out adaptive features as if

by an invisible breeder. He believed that while humans could apply artificial selection to the breeding of plants and animals, Nature's own selecting hand was infinitely superior.¹⁰

Darwin's strategy was to stick to facts about species and let Creation collapse by itself.¹¹ He advised the German naturalist, Ernst Haeckel, who was determined to present Darwinism in Germany in an anti-clerical package, not to lance the theological boil as it "will excite anger, and that anger so completely blinds everyone." Darwin warned Haeckel against needlessly making enemies for "there is pain and vexation enough in the world."¹²

In his later years, after the publication of his major works, many admirers would press Darwin about his religious views. He would reply with circumspection, for example, saying the question of God's existence is "beyond the scope of man's intellect."¹³ Sometimes, he would dismiss the question with the comments that what he believed was of no consequence to anyone but himself. Some observations from his Journal were more revealing when he questioned how belief in God and immortality could be justified given the conflicting evidence. He felt that inward convictions and feelings about such subjects, like other instincts, had been given a survival value by evolution. At times, he felt himself a theist, and then would discount his own feelings. He was a true agnostic. As for the ultimate origin of life, Darwin once said to his friend Hooker that life's initial appearance on Earth was inscrutable and all that should concern a naturalist was its subsequent change.¹⁴

In the final sentence of *The Origin of Species*, after summing up the components of natural selection, Darwin concludes:

"There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator 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 beauti-

ful and most wonderful have been, and are being evolved.”¹⁵

When pressed by atheistic friends who argued that “agnostic” was a respectable synonym for atheist, and that the word, “atheist,” was but a term for aggressive agnosticism, Darwin retorted: “Why should you be so aggressive?”¹⁶ He saw little point in disputing matters that could not be proved or in forcing ideas on others. He realized that people’s ideas, like species, change gradually.

Darwin’s Impact

It is probably as premature now to attempt to cover the impact of Charles Darwin as it was in 200 CE to assess the impact of Christianity, for big ideas can take many hundreds of years to work their way through and into human beliefs, customs and institutions. Nevertheless there are some discernible trends that give hints of what may come over the long-term.

The Origin of Species provided a breakthrough. In the century prior to its release, the idea of evolution had been proposed by some scientists but none demonstrated convincingly how it occurred until Darwin put forward the theory of natural selection, well supported by evidence. He thus provided a cohesive foundation for the science of biology and inspired subsequent generations of scientists to build and test its premises. For a century and a half, the theory of natural selection has withstood scrutiny and proved itself in new applications, for example, in genetics and the study of DNA. Viruses such as AIDS and H1N1 influenza show how quickly life adapts to changing circumstances as we humans struggle to develop vaccines to keep up with the ability of life to evolve in response to changing circumstances. One wonders why the theory has not been deemed a law, since it is widely accepted except by those who are determined not to believe it for ideological reasons. There are some who suggest that *The Origin* is the book of the second millennium.¹⁷ High praise indeed!

In his works, Darwin focussed his ideas on biology and avoided applying them to other fields such as religion, even though he was acutely aware of the implications of his work for the biblical story of Creation. However, the idea of natural selection was too big to be contained within science. It goes to the root of the eternal questions that have always attracted humankind: Who am I? Where do I come from? Where am I going? It tore off the elaborate system of religious symbols woven to comfort the sensitive human psyche. Deprived of a Father-Creator who oversaw each sparrow, we humans found ourselves orphaned, left to the indifference of chance and chaos, our new parents, who conceive but do not raise us. Part of the teeming mass of life in constant change, humans are tossed into the forum to battle for scraps with the winners passing on their genes to future generations. The meek shall be cast off with other genetic waste.

Throughout history, during times of transition, the tendency is for humans to jump from one set of beliefs into another. This has occurred in the Western world as the influence of Christianity has diminished. Humans respond much like ants when their nest is broken open. We scurry about with a mixture of panic and purpose to repair the breach in our collective software, our shared customs and beliefs, often with disastrous consequences.

The theory of natural selection is so profound that many other disciplines, including philosophy, politics, economics, and sociology, have appropriated aspects of it. With true human perversity, the awareness of natural selection soon led to unnatural selection. In the 1860s, Francis Galton, proposed that the British population should be improved by selective breeding. Darwin considered the idea Utopian. The German naturalist, Ernst Haeckel, a vigorous advocate of Darwinism in Germany, applied evolution to a universal theory of development where he linked the laws of biological and national evolution into a vision of a new Teutonic

superiority in a unified Germany.¹⁸ He prepared the foundation for the application of eugenics that formed part of the concept of a “master race.”

In British politics, the various classes interpreted Darwin to support their respective platforms. Those at the top of society justified their position based on the survival of the fittest. Those in the lower classes argued that evolution was driven from below in the same way that the basic cell had evolved into more complex life forms. The rising business class viewed competition and change as essential to maintaining British dynamism. Socialists, following the thinking of Alfred Russel Wallace, argued that natural selection was based on the environment eliminating the unfit rather than on cut-throat competition among individuals. In their view, evolutionary forces worked towards a just society and the realization of the “perfect man.” Wallace saw mutual assistance as being all important within society where the sick are looked after and food shared for the collective good. Marxists built on this theme. The development of a cooperative ethic by natural selection was compatible with Darwin’s views, but Wallace saw it leading to a Utopia, while Darwin believed that English society would stay vital only through unimpeded competition. This divergence of opinion is found in contemporary politics and reflects the contradictions of the human condition which struggles to reconcile each person’s consciousness of being an individual with membership in a social species.

Darwin’s theory of evolution struck deep into human psychology. Our high intelligence and acute consciousness of our mortality evoke an inherent narcissism which manifests itself as the desire for limitless self-extension, for recognition of what might be called our cosmic significance. This impels us to be heroes to ourselves and our species by taking action in the world, often to the detriment of other life forms. The fear of death haunts the human animal and is the mainspring of human activity.¹⁹ With his theory of evolution, Darwin aggravated our fear

of death by making evident that the human species is not a fixed creation of God but a part of all life that is constantly changing. We emerged by chance from the building blocks of cells and bacteria, and most certainly will be reabsorbed into the soup of life. This means that each individual, if they are perceptive, worries not only about personal demise but also about the eventual collapse and disappearance of the human species.

Darwin’s insights helped to undermine the influence of Christianity and belief in an afterlife. The hope for an eternal life in Heaven had a calming effect on the human psyche. The realization by increasing numbers of people that this life on Earth is all that they can expect has unleashed a frenzy of activity to defer death and to attain cosmic significance, with negative effects on the ecosphere.

As science began to unravel the mysteries of natural laws, we humans have been unable to resist manipulating the laws to meet our needs. High on the list of priorities are actions to cure diseases, alleviate hunger, and to prolong human life, in other words, to defer death and reduce human anxiety. The roots of many of these initiatives are grounded in Darwin’s work, and their success is measured by the growth of human numbers from about a billion in 1859 to 6.8 billion in 2009. The contributions of applied science to human well-being have generated optimism and a belief in progress made manifest for the masses by consumer goods produced in great abundance by the market economy. Increasingly, faith has been transferred from the promise of a spiritual future in Eternity to a material Now, from a universal God to the “invisible hand,” and to the assumption that economic growth can continue indefinitely on a finite planet to meet expanding human demands. The intense focus on economic growth has distracted us from the ever-present fear of death. Reminders of economic recession or depression summon the spectre of the Grim Reaper.

This has led to a global environmental

crisis. To meet almost insatiable human wants, the industrial economies are engaged in rapidly drawing down finite natural resources many of which are becoming scarce. This has created a situation of overshoot which is the condition of exceeding for a time the sustainable carrying capacity of the habitat. In 2004, the authors of *Limits to Growth: The 30-Year Update*, estimated that current human demands exceed the long-term productivity of the living Earth by about twenty percent.²⁰ The transition from living sustainably on the Earth to drawdown can happen seamlessly. Overshoot can start with a surge of wealth, for example, as occurred with the discovery of oil in many parts of the world, and the resulting prosperity in the short-term reinforces the belief that this is the proper way to proceed. Now, the litany of dreadful environmental facts grows by the day. The poisonous by-products of our activities threaten the future of all life on Earth. This creates another layer of anxiety, an awareness of three dimensions of mortality, with the concern that current human actions may extinguish life as we know it added to the fears of personal death and the future demise of the species. It is likely that a crash of unprecedented magnitude will cull human numbers in the coming century, but this would not have surprised Darwin or Malthus. It is natural selection at work.

Darwin's thinking revealed a more balanced direction for humankind but it did not appeal as much to short-term instincts. Once Darwin set out the probability that all life had evolved from a spontaneous event in the distant past, it became evident that all species are inter-related and interdependent. This is a humbling insight for those open to its full implications. In 1866, seven years after the publication of *The Origin of Species*, Ernst Haeckel coined the term ecology, an integrative science that examines the relationships of organisms and their environment. It is ecology that offers a sane direction for human beings if we have the discipline and rationality to adhere to it.

Darwin considered it absurd to talk of

one animal being higher than another, noting that while humans would view the development of intellectual faculties as the key indicator of attainment, bees would choose instincts as the criterion. Darwin's ability to take a non-human orientation was a break with conventional wisdom and theology. Even the radical Lamarckians had kept humans at the top of the chain.²¹

In both the Judaeo-Christian tradition and in the secular worldview of economic growth, human beings behave arrogantly, largely indifferent to the decimated landscapes and extinguished species in our wake. Our ethics have focussed on relationships among people, not between humans and other life forms. Humans comprise just one of many species and not the one most essential to the maintenance of life on Earth, except in the negative sense that we appear to have the capacity to destroy it.

Clearly, we humans have to move quickly from anthropocentric ethics to ecocentric ethics if we are to have a chance of avoiding a long and painful collapse. Darwin and ecology brought to our awareness that ecosystems comprise a complex on-going dance of interrelationships not only with other organisms but with the inorganic.²² Some scientists work feverishly to preserve endangered species, including storing their DNA in gene banks. Thanks to recent developments in cryobiology, it is possible to keep tissues alive and unchanged for hundreds of thousands of years. But collectively, we behave as a species on a rampage seemingly incapable of the restraint that is needed so urgently. This implies the hard-wiring of instincts. It is likely that we cannot change our behaviour enough to avert the collapse that follows overshoot.

It can be argued that if primates with large brains run amok on the planet, destroying thousands of species, that this too is natural selection in action. To what extent can we remedy and reverse the damage we are doing? For all its strengths, the human brain has trouble dealing with the complexity of life. Often, it focuses on the solution of one problem only to create

many others. For example, the cane toad was introduced into Australia in 1935 to control the native greyback cane beetles. The 102 toads initially released have increased to an estimated two hundred million. They are voracious predators, can weigh up to 2.6 kilograms, and are highly poisonous. They have wreaked havoc on indigenous species. Those animals that attempt to prey on the toads are poisoned while the toads eat anything they can.

Nature may be giving up on the experiment with big brains which require a lot of energy to function. The human species has been undergoing a gradual reduction in brain size over the past 35,000 years. Early modern humans had brains that averaged about 1450 grams, whereas the average for contemporary humans is about 1300 grams.²³ The reduction in brain weight has been associated with a parallel reduction in body weight at least until one hundred years ago when more abundant food increased the average weight. However, as humans have gained mastery over the world, we have reduced some of the factors of selection that formerly would have removed the less fit from the breeding stock. In a similar vein, dogs have brains about two thirds the size of wolves of comparable body size.²⁴ The process of domestication leads to a reduction in brain size. Since humans have taken over the responsibility of feeding and sheltering dogs, the necessity for dogs to maintain a larger brain has diminished. The welfare state may be having the same effect on humans.

How would Charles Darwin respond to such disquieting facts? If someone had proposed to him that humankind should take over the genetic design of our own species, he would probably warn that in matters of evolution Nature's own selecting hand is infinitely superior. We may be in the process of learning that lesson the hard way.

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