# DARWIN

Charles Darwin was one of the most influential scholars of his time. His ideas continue to have a far-reaching impact and influence on modern thought in the arts and on society, as well as in science. With contributions from leading scholars and respected communicators, this collection of essays is written for the general reader but from the standpoint of the leading researcher. They explore how Darwin's work grew out of the ideas of his time, and how its influence spread to contemporary thinking about the limits of human evolution and the diversification of living species and their conservation. The book provides a full account of the legacy of Darwin in contemporary scholarship and thought.

Featuring contributions from Janet Browne, Jim Secord, Rebecca Stott, Paul Seabright, Steve Jones, Sean Carroll, Craig Moritz, Ana Carolina Carnaval and John Dupré, this book derives from a highly successful series of public lectures.

WILLIAM BROWN is the Master of Darwin College and Professor of Industrial Relations in the Economics Faculty at Cambridge University. His research has been concerned with collective bargaining, pay determination, incomes policy, payment systems, arbitration, minimum wages and the impact of legislative change. In 2002 he was awarded a CBE for services to employment relations.

ANDREW C. FABIAN is the Vice-Master of Darwin College and Royal Society Professor of Astronomy at the Institute of Astronomy in the University of Cambridge. His research interests centre on black holes and clusters of galaxies. He has organised several previous Darwin Lecture Series (*Origins* in 1986, *Evolution* in 1995 and *Conflict*, with Martin Jones, in 2005). He is a Fellow of the Royal Society and was awarded an OBE in 2006.

In the second term of every academic year since 1986, Darwin College, Cambridge has organised a series of eight public lectures. Each series has been built around a single theme, approached in a multidisciplinary way, with each lecture prepared for a general audience by a leading authority on his or her subject. Collections of these lectures are published by Cambridge University Press.

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THE DARWIN COLLEGE LECTURES

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# Contents

Contents

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# Introduction

Two hundred years after his birth, Charles Darwin's reputation has never been higher. His influence upon both biological science and our broader understanding of humanity continues to be profound. In this book, leading authorities in different fields are brought together to evaluate this influence, how it has developed and how our understanding has moved further. Their contributions originated in the 24th annual series of public lectures organised by Darwin College, Cambridge, a series which has always called on leading scholars, across the range of disciplines, with outstanding reputations as popularisers. It is, accordingly, the purpose of this book to provide a broad overview of current thinking on Darwin's influence, and one which will be widely accessible.

We start with Darwin's impact upon his own world, and how this was to echo through the wider realms of arts, literature and the social sciences, each responding to the reflected insights from different facets of his work. The story then moves to biological science itself, now able to deploy analytical tools unimaginable 200 years ago. What can we say about human evolution? What does modern science say about the evolutionary process and the implications of environmental degradation? And where does subsequent science put Darwin's theory? Is it as robust as when it was conceived, or has it been augmented by complementary or competing theories of origins of species?

Few thinkers of the modern age can compete with the magisterial popular image of Charles Darwin. Janet Browne starts the book, exploring the making of this image in an essay on biography. She shows how successive generations have, according to their changing concerns, reinterpreted Darwin as safe and domesticated, or as a tormented iconoclast, or as an archetypal biologist. And, most recently, we have come to

see him as a supreme networker, absorbing and combining the emerging ideas of his age through tireless use of the penny post.

The potency of Darwin's incessant letter writing is taken up by James Secord, who shows how he used it to focus a variety of widely discussed, if inchoate, theories of evolution. By mobilising a great array of widely collected facts, Darwin did not so much produce a new theory as legitimise both an emerging theory and, at least as important, a way of doing science. Thus focused, the debate he provoked was to have a catalytic effect on different local debates among scientists right around the world.

Nor was the influence confined to science. The notion that living things were not created, once and for all time, in their present form, but that they have changed and continue to change form in response to environmental and other pressures, was deeply subversive. It was to have a profound and recurring impact on humanity's view of itself as well as of the natural world. Rebecca Stott explores how this has influenced literary fiction, an art form of which Darwin was particularly fond. Optimistic views of mankind as the pinnacle of creation could hardly survive the horrors of the twentieth century. By drawing our attention to the elegiac quality of much of Darwin's prose, she emphasises the tangle of delight and terror with which he himself viewed his conception of life's central process, where death is the inextricable companion to natural beauty.

Contrary to popular opinion, cooperation was as important as competition for Darwin. How this has shaped our understanding of human society is explored by Paul Seabright. Drawing on studies of primates and primitive human communities, he shows how collaboration is itself central to the competitive process. Humans developed as they did because there were substantial survival benefits to be gained from complex cooperative behaviour. The development of institutions and of cultures was accompanied by a steady decline in the incidence of deliberate, violent death. The consequent importance of sexual selection for humans makes it particularly notable that it is so difficult to find significant differences in overall cognitive abilities between men and women. The implication is that, as our species' distinctively complex cooperative behaviour evolved, the genders were facing equally demanding cognitive challenges.

This brings us to the question of whether we, as humans, are continuing to evolve. Steve Jones tackles this question from his background in genetics. For Darwin, the central characteristic of living things is that they make copies of themselves. But they do so with small errors, and their continuation through natural selection feeds on the improbability that small, inheritable variations will fit changing environmental circumstances. Civilisation tends to stifle this process. People increasingly die old, not young, having passed on their DNA. There is less variance in family size, in personal survival and in reproductive success. The variation associated with inbreeding has become less likely because we have changed from being an often endangered species to one that has become, relative to other species of comparable body size, enormously abundant, and also more mobile. If humans are going to get better, it will have to be by using their brains. So far as natural selection alone is concerned, barring disasters, we are probably as good as we are going to get.

Part of the challenge facing Darwin in getting his ideas accepted was that people have, inevitably, a deeply parochial awareness of the natural world. Evolutionary processes that involve geological time and molecular distances are beyond our comprehension. The notion of a constant transformation of species across time and space challenges our daily experience. However, modern molecular biology has provided the means to explore these elusive dimensions. As a result, evolutionary research has moved from the collecting and analysing of species of Darwin's day to collecting and analysing their DNA sequences.

The opportunity to look far back in time is offered by the curious fact that the redundant genetic codes of past forms are to be found within species' living DNA sequences. Sean Carroll discusses how these biological fossils permit the exploration of the evolutionary history of species. They show how species have adapted to changing environments. A constant 'arms race' of evolution changes both the hunters and the hunted. The frequent repetition of evolution shows how similar selective conditions favour similar genetic variations in different species, at different times, in different parts of the world. Modern species are not 'better' than their ancestors; they are just different.

The importance of spatial separation for evolutionary processes was evident to both Darwin and his great contemporary, Alfred Russel

Wallace, who were famously inspired by the distinctive fauna of islands. Biogeography has subsequently become a central part of their legacy. Craig Moritz and Ana Carolina Carnaval discuss how the mapping of biodiversity has developed. However, their main concern is with the processes whereby biodiversity is first generated, and then preserved. Newly evolved species are associated with complex topographies, steep environmental gradients, novel environments and recent climatic stability. But the dominant factor influencing the preservation of species appears to be the stability of overall climate conditions. As the planet faces hastening climate change, biodiversity prediction is central to effective conservation policy.

Our discussion of Darwin's heritage ends by questioning the dominance of the theory based on the combination of Darwin's natural selection and Mendel's genetics. John Dupré argues that science has taken us much further. For the most numerous of organisms, microbes, lateral gene transfer provides no lineal descendants. The tree of life merges as well as branches. And for more complex bodies, symbiosis has taken forms in which distinct organisms have bonded in cooperation to create new life forms. Evolution has often been by merger. The definition of an organism is itself an issue. Might it not be more useful to envisage the typical organism as a collection of cells of different kinds, organised cooperatively to maintain its structure and reproduce similar structures? And if that is so, might it not be appropriate to focus not on a single genome, but on the life cycle of the self-copying multigenomic whole? In seeing evolution as a mosaic of more or less related processes, we do not detract from Darwin's achievement, but rather acknowledge the fertility of the intellectual revolution associated with his work.

There is no doubt that Charles Darwin was a superb scientist. He spent so much of his life being curious about many aspects of the world around him, particularly the biological world. The extraordinary opportunity of the *Beagle* voyage followed by a life devoid of financial worries produced such enormous dividends in so many ways. It makes one wonder how a similar mind would thrive in today's grant-driven environment. In a way, Darwin had one vital luxury which is in short measure today, and that is time to experiment and think.

This collection of essays would not be complete without an acknowledgement to the many members of Darwin College who facilitated the lecture series, and in particular to Richard and Ann King for their generous financial support, and to Janet Gibson, who brought order to both the contributors and their manuscripts.

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