

A Farewell to Charles Darwin

ANBG Volunteer Guides Monthly Meeting, 16 February 2010

This is the first of a series of short talks on great botanists. The idea came from the report of 'No Show' committee.

Last year (2009) we heard a huge amount about Charles Darwin (b. 1809) and his book, *The Origin of Species* (1859). As a historian of 19th century England and now a guide, I'd like to give my own take on what we've heard by summarising, drawing out some of the implications for us as guides, and providing some context.

I. Darwin's Significance

More than 120 species, nine genera, one important transitional fossil ('Darwinia') and numerous geographical features have been named after Charles Darwin.¹ The finches he studied are now known as 'Darwin's finches'. Clearly he made a big impression, but what exactly was his significance?

- a. Was *not* that he invented the idea of evolution. The ancient Greeks, Romans and Chinese had known it, as had medieval Islamic scholars. Erasmus Darwin, Charles's grandfather, had been an evolutionist, as were a number of other prominent British thinkers of the late 18th century; the leading advocate of evolution was the Frenchman Jean-Baptiste Lamarck, who published a book in 1809 that is generally credited with being the first coherent exposition of the subject.²
- b. Darwin's importance was first that he hit upon a plausible mechanism by which evolution might have occurred - 'natural selection' or (later) 'the survival of the fittest'³ - and, second, that
- c. He provided a mountain of evidence to support the theory. All those years spent on *The Beagle* and in Kent (on the experiments Rosemary Purdie has described to us) were not wasted. Although the evidence was not conclusive, it was persuasive. In this respect it was crucial that Darwin's examples were readily identifiable - for example, he wrote about domestic pigeons - and that the fact of random variations in descendants was something every parent could identify with. (One of the main reasons for the unpopularity of evolution up to 1859 had been the objection that it was impossible to see the transmutation occurring in the contemporary world.) He also married his argument with some of the most popular nostrums of the day, particularly the doctrine of

¹ See the Wikipedia entry on Charles Darwin, which cites www.Darwinfacts.com. The total includes animals and plants.

² Later editions of *The Origin of Species* contained a survey by Darwin himself of the history of the idea up to 1859.

³ Lamarck had posited two mechanisms, one an 'alchemical' force driving change within the organism and the other the environment or 'soft heredity' - the idea that changes produced by environment in one generation can be passed on to the next. Darwin rejected both, though he did allow a small role for Lamarckian environmental factors. Darwin's use of the phrase 'survival of the fittest' occurred not in 1859 but in later editions of *The Origin of Species*.

progress, which was like motherhood then, and Malthus's theories on population.

By these two actions, positing a credible mechanism and providing a mass of persuasive evidence, Darwin seemed to demonstrate the validity of an idea that previously had been dismissed almost out of hand by most natural historians and by society at large. His friends and supporters, notably T.H. Huxley, did the rest.

But what does that mean? What was 'the rest'? What transformation of opinion did Darwin and his allies achieve? After 1859 nearly all scientists rapidly (i.e. by the end of the 1860s) accepted the general idea that species change over time ('descent with modification', as Darwin called it, or evolution) as opposed to their being created separate and immutable (essentialism). Very importantly, this included the revolutionary idea that man was not a distinct and higher form of life created specially by God but was rather the product of evolution from ape-like ancestors i.e. perhaps the most developed animal but still part of the animal kingdom.⁴

However, with Darwin's mechanism, natural selection, the story is very different. Opinion has waxed and waned. Even before the publication of *The Origin of Species*, some of Darwin's closest friends and supporters, people like T.H. Huxley, could not agree with him on natural selection. In what he later called 'a most conspicuous position' viz. at the end of the Introduction, Darwin declared in the first edition of *The Origin of Species* that natural selection was 'the main but not the exclusive means of modification' of species. After 1859, with this generous amount of weasel room, he continually modified his position. Among natural scientists there was much debate and growing disagreement, so much so that sources talk of 'the eclipse of Darwinism' (1880s onwards). Then in 1900 came the re-discovery of the work of Gregor Johann Mendel, the monk whose research on 29,000 garden pea plants had been published in the mid-1860s. When eventually this was combined with new ideas and discoveries about chromosomes, the science of genetics was created and with genetics came the very influential sub-discipline of population genetics. As far as evolution was concerned, the effect was to validate the idea of natural selection and undermine the rival, often neo-Lamarckian positions (1920s, 1930s, 1940s). So after WWII (1947, to be precise) there reigned 'the modern evolutionary synthesis', which might be described as neo-Darwinian in that it gave a privileged position to natural selection as a cause of the development of species.⁵ But science does not stand still. Since the 1960s breakthroughs in molecular science, DNA sequencing, mathematical modelling and computers, phylogenetics⁶ and similar areas have created debate all over again, so that now there is considerable disagreement among scientists over the degree of importance and precise meaning of natural selection, though at a highly sophisticated level.

⁴ Note that Darwin refused to employ the terms 'higher' and 'lower'.

⁵ One feature of the 'modern evolutionary synthesis' was that it rejected saltationism, the idea that evolution occurs not gradually but in leaps. While emphasising gradualism, 'the modern evolutionary synthesis' stressed that gradualism did not imply development at a uniform speed. The synthesis also downplayed the importance of 'genetic drift' and posited that the unit or object of selection was the phenotype (any observable trait of an organism such as its morphology or chemistry).

⁶ Phylogenetics is the study of the evolutionary relationships between different groups of organisms (e.g. species). Witness Joe Miller's acacia 'tree of life'.

Nevertheless and for all the sophistication of this debate, for all the modification of his ideas, the march of scientific research has broadly supported Darwin's position on both evolution and natural selection: it has actually raised his stature as a scientific genius, a remarkably prescient scientific genius.

What does this mean for us? There are many interesting points to be made, but I will mention only a few.

First, a lot of the botanical concepts we take for granted are actually the product Darwin's work and the ensuing debates. A particularly interesting example is the classification of organisms into six kingdoms. When I trained it was part of the course. This classification is a reflection of the 'three domain system', which argues that a common single cell ancestor gave rise to three different cell types, each representing a domain. Two domains led to single kingdoms, but the third developed into four, giving a total of six kingdoms.⁷ This outcome represents a general rejection of the popular Darwinian 'tree of life' metaphor with its five kingdoms. The 'tree of life' is out, supplanted by something like the trident of life. But evolution remains. Darwin has been both supported and corrected.

Second is something I was dimly aware of - we have had talks on botanical name changes and, I remember, a particularly technical talk in the Thursday lecture series on the mulga. What underlies these talks is a debate over the *basis* of classification (systematics), which arose during the larger debate about evolution and all the new discoveries about genes and so on. Should we classify plants according to their observable characteristics, as per Linnaeus and his successors up to the 1980s, or according to their ancestry as defined by molecular genetics and DNA? The question, the sources say, has now been answered definitively in favour of ancestry, a victory for the neo-Darwinists, but ancestry with some account taken of the historical development of observable features. As a result, in future we are likely to see many more re-classifications and name changes - unfortunately.

Third, evolution is all about adaptations and on our walks we talk about adaptation a lot. This is necessary and enlightening for our visitors. But we need to be careful, to be aware of some of the generally accepted ideas of the advanced researchers in the field these days. For example, it is easy to give the impression that a plant is a collection of features, every one of which exists to increase its chance of survival. There is little current scientific justification for such a conclusion. In the first place, scientists are now emphatic that an organism is more than just a collection of traits. (They would probably stress the historical development of the organism, the growth of the organism from seed or embryo into adulthood, the interaction between the parts of the plant and between the plant and its environment, and so on.) Furthermore, many, perhaps most, plant features, they say, are there by chance and serve no particular purpose. According to those who have looked at the whole range of possible adaptations, the idea that populations have evolved in the best possible way for their survival is also generally insupportable. That is, few plant populations can be described as ideally suited to their environment. Again, traits that advantage the

⁷ The three domains are the *Archaea* (archaebacteria), the *Bacteria* (eubacteria), and the *Eukarya* (eukaryotes). The *Eukarya* are then divided into 4 kingdoms: Protists, Fungi, Animalia, and Plantae. (From the internet article for students on the three domain system of classification.) The other two domains represent single kingdoms.

plant in its current environment might have developed before that environment came into existence (a good example is the development of phyllodes in acacias, which developed before the drying out of the climate and so cannot have been an adaptation to aridity, however much they advantage the plant in the current climate): the search for the explanation of adaptations must always have a historical element. So as guides we need to continue to talk about adaptations but to do so carefully lest we inadvertently create impressions that are not justified by the latest research.

Fourth, the relationship between an organism and its environment is seen differently now. There was a sort of presumption among earlier evolutionists that the organism (or the plant species in our case) adapted to the environment even if this adaptation occurred through random variation. Now scientists suggest that, even if organisms react to the environment in this way, they might also influence their environment – just as, for example eucalypts promote fire. The relationship, in other words, is reciprocal rather than one-sided. And in any case that environment is not a monolith, not a given, but the product of innumerable interactions between endless numbers of other organisms.

Fifth, when we talk about natural selection or 'the survival of the fittest', what do we mean? The fittest what? What is the unit of selection? There has been much scientific debate on this point since the 1960s. I'm not qualified to talk about that particular debate, but I can give you some idea of its importance from an area I do know a bit about: social darwinism. Social darwinism was never authorised or supported by Darwin⁸, but some of his disciples, notably Herbert Spencer, developed a social philosophy based on the principle that since life is an unremitting struggle in which only the fittest will survive, the individual is justified in doing anything to promote his own interests. This position was very influential in the late nineteenth century, particularly during 'the age of the robber baron' in the USA. It's broadly the philosophy put forward later by Ayn Rand: rampant individualism. Or, in its more moderate incarnations, classical or laissez faire liberalism. But what if 'the fittest' is not the fittest individual but the fittest society? British thinkers and some politicians like Joseph Chamberlain took this view, which led to conclusions the direct opposite of the individualistic version of social Darwinism: social welfare policies and building a strong sense of community. Again, what if the fittest is not a person or a society but a class? Karl Marx was very impressed with Darwin and wanted to dedicate *Das Kapital* to him - Darwin declined the honour. In other words, the identity of the unit of selection - whether the molecular genetic unit or the plant or the species or something else - is absolutely critical.

Sixth, the previous point relates closely to another feature of the most recent discussions of natural selection: the emphasis on 'zoom' and 'grain'. Broadly scientists now lay increased stress on the scale of research, whether, for example, one is looking at whole populations or at some smaller, perhaps even molecular, part thereof. The impact of this approach is to distinguish between areas in which natural selection might be all important and others in which it might be less so, perhaps much less so.

⁸ Though he did suggest that a science of man was as possible as a science of nature.

So, whether we know it or not, we as guides and students of botany are all heirs to Darwin and the discussion he generated - in these among other ways. And we should be aware of the nuances of modern thinking in this area so we don't convey false messages to our visitors.

II. Context

a. Much has been made of Darwin's fear of the controversy his work would evoke and in fact of the controversy itself, especially by Ian McCalman. It is difficult to understand this unless you know that mid-Victorian England was, among highly civilised societies, one of the most religious the world has ever seen (Ensor). Think present-day USA on religious steroids. Think family prayers and sometimes short sermons held daily, sometimes twice daily, in many homes. Think the great missionary surge, when Britons set out to spread the gospel to all the world. Think hellfire preaching and the joys of eternal life, which were very real to contemporaries. Think of evangelicalism and its 'eternal microscope', which gave to every action - every thought, even - 'its individual value in this life, and its infinite consequence in the next' (G.M. Young). Think that, for most people, the Bible was the ultimate authority in all scientific, historical and social as well as religious and moral matters. The majority, if they could read at all, had learned to read through the Bible. Mid-Victorian England was, and saw itself proudly as, a religious society.

But a number of factors were undermining this pride. For example, the religious census of 1851, the first ever conducted in the UK, showed that only half the population attended religious services. Christians nowadays would be happy with such a figure, and so no doubt would those of earlier centuries have been. But to the Victorians the result was profoundly shocking. So Darwin's *Origin of Species* (1859) with its challenge to established thinking came at time when Victorian believers already felt threatened. The reaction to *The Origin* was consequently more fevered and hostile.

b. This context also explains another important point, one that was completely ignored during 2009. Although Darwin's *Origin of Species* provoked controversy, it was by no means the major issue of the time. More immediate and furious was the reaction to a publication with the misleadingly bland title *Essays and Reviews* (1860). This was a collection of seven articles which gave public currency for the first time to the new scholarship. Collectively their effect was to present the Bible as a historical document needing interpretation based on historical, theological, geological and other understandings rather than as the Word of God through which He spoke directly to the individual reader. Since the authors were six prominent Anglican clergy and one leading Anglican layman, its publication is often taken as the start of the chasm that opened up in the late nineteenth century and continued throughout the twentieth between the Christianity of scholars and the belief of the ordinary churchgoer. *Essays and Reviews* sold 22,000 copies in its first two years - *The Origin of Species* took twenty years to sell as many. The outrage at *Essays and Reviews* led the Convocation of Canterbury to convict two of its contributors of heresy - !! in the C of E !! - and cost them their livings, though the Judicial Committee of the Privy Council subsequently quashed the convictions.

III. 1859 - a good year for books

I have mentioned before that 1859 was a good year for books. Darwin's was not the only important work published that year. You may be interested in the titles of some of the others:

John Stuart Mill, *On Liberty*, which is the classic statement of liberal political philosophy. It still provides the intellectual basis of our political life, quoted as it is so often even by people who have never read it and do not know where the ideas or words come from.

Samuel Smiles, *Self-Help*, which encapsulated an idea – bizarre to us but wildly popular in Victorian times - that by hard work, thrift and self-control one could rise from the social mire of dependence and poverty not necessarily to great wealth but to something much more valuable, respectability. This is the way of thinking that gave us the adages we heard from our grandmothers: 'a penny saved is a penny earned'; 'penny wise, pound foolish'; 'cleanliness is next to godliness'; 'drink is the curse of the working classes' etc. Sold 20,000 copies in its first year, a quarter of a million by 1904.

Charles Dickens, *A Tale of Two Cities*

Alfred Lord Tennyson, *Idylls of the King*

George Eliot, *Adam Bede* (her first novel and a big success)

George Meredith, *The Ordeal of Richard Feverel*

Edward Fitzgerald, *The Rubaiyat of Omar Khayyam* (which was almost unnoticed)

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February 2010

A Note on Sources

Most of the technical information comes from the internet, particularly articles listed by Google under 'Charles Darwin', 'Evolution', 'the three domain system', and similar terms. I paid particular attention to the relevant feature articles in Wikipedia. 'Adaptationism' by Peter Godfrey-Smith and Jon F. Wilkins, an entry prepared for the *Blackwell Companion to the Philosophy of Biology* and available on the internet, was especially useful, though parts of it require a lot of extra reading before they can be grasped.

The main source for the historical material above was my lecture notes. Most of the points made are well known to historians of the period.