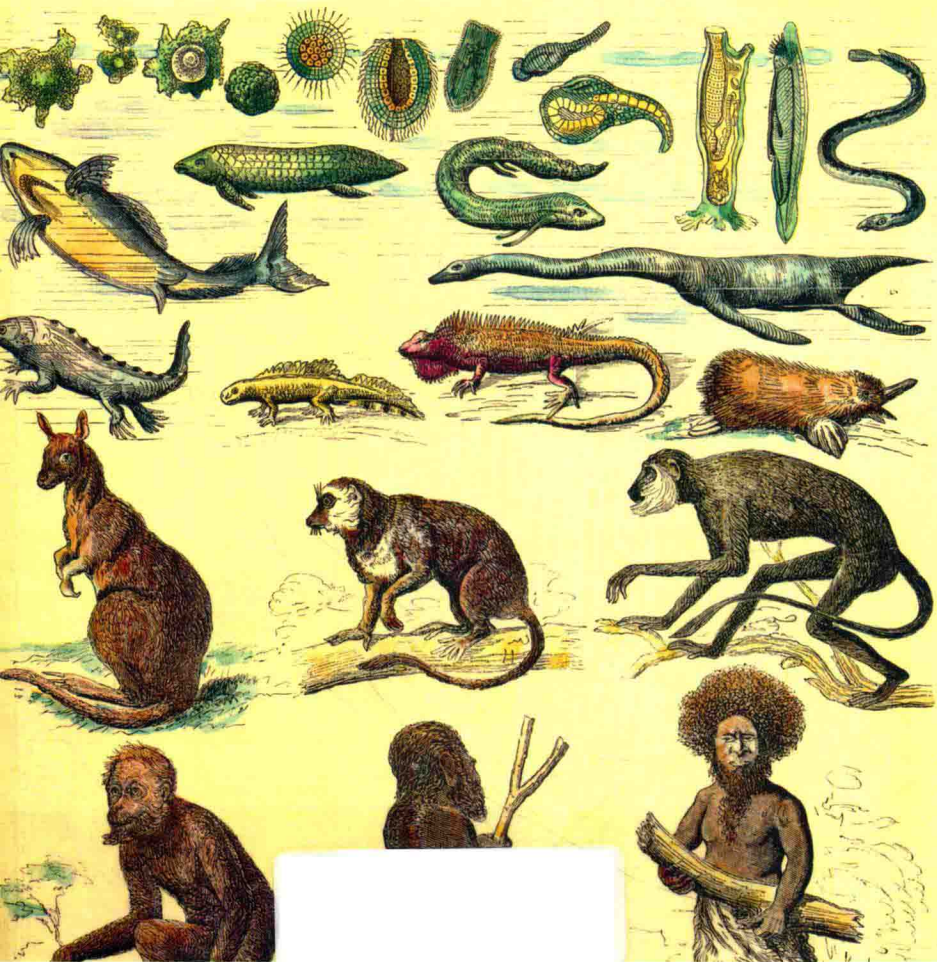


OXFORD WORLD'S CLASSICS



On the Origin of Species

物种起源

Charles Darwin [英国] 查尔斯·达尔文 著



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ON THE ORIGIN OF SPECIES

CHARLES DARWIN was born on 12 February 1809 to Robert Darwin, a highly successful doctor, and his wife Susannah Wedgwood, a member of the famous pottery family. His paternal grandfather was the free-thinking scientist and poet Erasmus Darwin, who was formulating evolutionary ideas at the end of the eighteenth century.

Initially training as a medical student, then intending to become a clergyman, Darwin found his life and thinking profoundly altered by a five-year round-the-world trip on HMS *Beagle*. Twenty-odd years lay between his initial formulation of the idea of natural selection and the publication of the *Origin of Species* in 1859, in the course of which he painstakingly drew together materials from an extraordinary range of sources and intellectual domains to confirm his observations and intuitions, which he understood from the start would challenge fundamentally both society's and science's assumptions. However, by 1871, when he published *The Descent of Man*, much of the first rancour of the debate concerning 'man's place in nature' had passed.

Throughout his life, Darwin was beset by intermittent debilitating illness, which nevertheless had the advantage of exempting him from public life and allowing him to concentrate on writing, reading, and observation. He was also profoundly affected by the death of several of his children in infancy. The *Autobiography* that he wrote late in life for his family makes it clear that he ceased relatively early in his career to have any religious faith and that he resented the punitive element in orthodox Christianity. He died on 19 April 1882 and, after controversy, was buried in Westminster Abbey.

DAME GILLIAN BEER has written extensively about Darwin and about scientific writing in its cultural context. She is Professor Emerita at the University of Cambridge, President of the British Comparative Literature Association, and Fellow of the British Academy and of the Royal Society of Literature. Her *Darwin's Plots* (1983; second edition 2000) was followed by *Open Fields: Science in Cultural Encounter* (1996). More recently she has been working on Carroll's *Alice* books in the context of nineteenth-century intellectual controversies and on a new collection of her essays on literature and science.

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INTRODUCTION

WHEN Charles Darwin published *On the Origin of Species* in November 1859 he presented it as a hasty introduction to his ideas, for which he would present further evidence in the future. So it may have seemed to him: the text was written in thirteen months after a gestation of more than twenty years. It was written in the anxiety of knowing that Alfred Russel Wallace, like Darwin himself earlier, had recently conceived of a process that Darwin would name 'natural selection'. Instead of all species having been created together at the beginning of time, or even at punctuated intervals through time, the present array of kinds throughout the world had come into being by a gradual process of genetic differentiation and selection under environmental pressures. Slight mutations could advantage individual organisms, and such mutations might then be enhanced over generations. This insight involved extinction as well as proliferation; it was disquieting in a great number of ways, however much each man later sought to palliate the disturbance.

The idea grew in both minds through extensive travel as natural historians, through detailed observation of natural phenomena around the world (not always the same parts), and through dream and reflection. In each case it seemed to the thinker that the full force of the theory seized him after reading Thomas Malthus's *An Essay on the Principle of Population* (first edition 1798), probably in the edition of 1826. Malthus argued that human population and population growth will always outrun resources of nutrition and space; therefore competition between those occupying common environments will control population.¹ Scholars have since discriminated the differences between the theories of Wallace and of Darwin and have demurred at, or emphasized, Malthus's role. In 1858, though, the insight the two men shared seemed close enough to drive Darwin at last into a steady frenzy of composition.

Darwin wished to marshal sufficient evidence to convince scientists adept in a variety of fields, from geology to botany to taxonomy and morphology. At the same time he wanted to address a very broad spectrum of readers, thus acting as fundamental initiator and popularizer at once. That is, the *Origin* was to speed up the process of reception, so that the ideas it contained could become available simultaneously to

¹ See Appendix I.

Darwin's fellow-workers in science and to any educated person. In this double task the book was quite remarkably successful, perhaps the more so as Darwin himself made no stable discrimination between the diverse audiences he was addressing. The language of the text is accessible and non-mathematical. Yet evidence is piled on evidence for colleagues to pursue, as the 'Register of writers referred to in the text of the *Origin*' at the end of this edition makes abundantly clear. The continuing fertility of Darwin's work for scientists is evident in the degree to which it is still a fundamental prerequisite for work in genetics and still a source of controversy in taxonomy.²

The extraordinary creativity of the writing, and its capacity to lend itself to contradictory social programmes, comes out of this liberal amalgamation of audiences. Indeed, this openness plays into—is part of—the vigour of Darwin's argument. It declares itself in the novelty of his associative power, and in his ability to pursue small discrepancies to large effect. Different readers can find their hopes and fears confirmed by extending the implications of Darwin's thought in one direction or another; and, it would later prove, those readers might be individualists, Fascists, Marxists, imperialists, or anarchists—or indeed, quietists. There is something fascinating and perturbing in a text that, while pursuing, in Darwin's words, 'one long argument', ballasted by multiple evidences, can generate such a variety of ideological potentialities.

To understand its impact in Western cultures over the past one hundred and fifty years, it is necessary to track the history of the work and its context. This will help the reader to analyse the process by which Darwin's ideas (or those associated with his name, not always to be found within the covers of this book) have come to have so dominant a role in the construction of social domains apparently remote from the biological. Darwin himself insisted always on constraining the extra-scientific implications of his work and resisted any overt politicization (itself, of course, a political position). Wallace, on the contrary, became an active socialist who saw evolutionism as caught into that enterprise. But it was Wallace who uncoupled the human from all other species development so as to preserve a place for the soul, and Darwin who, more radically, faced the complete integration of the human into the natural order. In this story no simple contraries survive.

² For a useful non-technical account by a variety of authors see Laurie Rohde Godfrey (ed.), *What Darwin Began: Modern Darwinian and Non-Darwinian Perspectives on Evolution* (Boston, 1985).

Above all, the *Origin* made its impact because it raised questions fundamental to the life of humankind without making humankind the centre of its enquiry. That shift away from the centre was a silent and intense challenge to the reader's assumptions. Survival and descent, extinction and forgetfulness, being briefly alive and struggling to stay so, living in an environment composed of multiple other needs, coupling and continuing, ceasing to be: all these pressures, desires, and fears are alerted in this work without any particular attention being granted to the human person. This is a history of a world in which the human has a place but has not always been present, and where other kinds have each their own lost and fitfully recorded histories: in the strata of rocks, in reproduction, in the silt of the deep ocean, on remote islands where conditions have not changed, in parthenogenesis or hermaphroditism (modes of production more stable than the two-sexed system humans share).

How did the work come to be? It began, as most projects do, before the author recognized its existence; perhaps before the author existed. To take that second prehistory first: there was a long hinterland of attempts to understand how the diversity of species had been established and whether changes had occurred through time.³ Some held to the view that all kinds had been stable from the start of the world; others that different species had been introduced at intervals in a 'progressive' sequence. The Mosaic version of creation presented Adam with a complete roster of living kinds come into being at one time, to name at his own will. That strong myth certainly continued to command belief, or institutional acceptance, in England up to and beyond the generation in the late eighteenth century of Darwin's innovative grandfather, Erasmus Darwin, who himself produced a proto-evolutionary treatise, *Zoonomia*:

all warm-blooded animals have arisen from one living filament, which THE GREAT FIRST CAUSE endued with animality, with the power of acquiring new parts, attended with new propensities . . . and thus possessing the faculty of continuing to improve by its own inherent activity, and of delivering down those improvements by generation to its posterity, world without end!⁴

³ From the 3rd edn. on (1861) Darwin prefaced the *Origin* with 'An Historical Sketch of the Recent Progress of Opinion on the Origin of Species'; in the 6th edn. (1872), in response to criticisms that he had been ungenerous to his predecessors, he added the phrase 'Previously to the Publication of the First Edition of this Work'. See Morse Peckham (ed.), *The Origin of Species By Charles Darwin: A Variorum Text* (Philadelphia, 1959).

⁴ Erasmus Darwin, *Zoonomia; or, the Laws of Organic Life*, 1 (2 vols.; London, 1794-6), 1, 505.

Darwin later distanced himself from his grandfather's theory by making it clear that there is no steady movement across all species towards complexity; it all depends on the relations between individual organism and medium:

As the variability of each species is an independent property, and will be taken advantage of by natural selection, only so far as it profits the individual in its complex struggle for life, so the degree of modification in different species will be no uniform quantity. (p. 258)

The biblical account had also been under persistent pressure, particularly since Linnaeus set out a new scientific taxonomy of the relations between extant plant and animal kinds. Various versions of natural change had woven in and out for centuries. 'Transmutation' was not a new idea; it had been explored in the early nineteenth century by French scientists such as Jean-Baptiste Lamarck and Étienne Geoffroy Saint-Hilaire and, long before them, in literary texts such as Edmund Spenser's *Faerie Queene* in the late sixteenth century. And metamorphosis, with its sideways motion, had been a familiar imaginative resource since Ovid and Apuleius. More directly, transformation within the individual life cycle was a familiar phenomenon among insects (butterflies were the most delightful and frequently cited example). This seemed to raise the possibility of natural change at a species level. Nor was the close relation of the human to other primates altogether ignored: Lord Monboddo insisted (to much mockery) that the orang-utan, though mute, was a brother to the human at an earlier point of development.⁵ And in discussions across a wide range of fields in the years before Darwin, the idea of 'development' was often figured as 'progress', or even—at the end of the eighteenth century in France—as revolution.

So these diverse elements, fruitful for evolutionary thinking, were already available and under discussion in intellectual and activist circles, some from long before Darwin was born and all before he was a grown man. Indeed, a number of recent historians have argued that, so widespread were these discussions at both a popular and a more technical level, that it is possible to construct a history of nineteenth-century evolutionary thinking almost without Darwin.⁶ And it is

⁵ James Burnett Monboddo, *Of the Origin and Progress of Language* (6 vols.; Edinburgh, 1773–92).

⁶ For example, Peter Bowler, *The Non-Darwinian Revolution: Reinterpreting a Historical Myth* (London and Baltimore, 1988); Adrian Desmond, *The Politics of Evolution: Morphology, Medicine, and Reform in Radical London* (Chicago, 1989).

certainly the case, as James A. Secord has convincingly demonstrated, that the anonymous publication of Robert Chambers's *Vestiges of the Natural History of Creation* had a galvanizing effect on public discussion of evolutionist claims, from its first appearance in 1844 through its fourteen editions.⁷ Even those who despised, or affected to despise, the work could not ignore its popular success, nor the degree to which it had stirred up and brought into question a settled cosmos. Moreover, the Darwin Correspondence⁸ and, modestly, the glossary of information I have put together in this edition about the men (and they all are men) whose work Darwin alludes to and absorbs bring out how densely he was involved in the scientific community of the time, both through reading and through letters and conversation. They show, too, how much research was under way that could be turned to Darwin's theoretical purposes.

Yet the reception and continuing influence of the *Origin* indicate how much remained to be accomplished. Major originality may be a matter, first of all, of condensing materials that would otherwise remain discrete observations. Darwin drew his evidences from an extraordinary range of domains, many of which he had studied at first hand. He brought to his task a career manifestly devoted to empirical research and observation. His notebooks also show how daring, quirky, radical, his questions to himself were: 'have plants any notion of cause & effect'; 'Has the oyster necessary notion of space'; '?Is the shortness of life of *species* in certain orders connected with gaps in the *series of connections*?'⁹

That curiosity and assurance allowed him to pursue hypotheses with immense energy and to take them on beyond the bounds of current data. His project moved back and forth along a trajectory from the present into a newly construed and imagined past. His invention of the term 'natural selection', with (among other things) its inhering time-span, gave him an analytical tool that was to prove an extremely powerful discriminator, though it brought with it also a set of philosophical and ideological questions that Darwin himself was puzzled to resolve, as I shall later discuss. Retrospect had all the narrative excitement of discovery. Darwin allows the reader to participate in a copious

⁷ Robert Chambers, *Vestiges of the Natural History of Creation and Other Evolutionary Writings*, pub. anonymously (Edinburgh, 1845); ed. James A. Secord (Chicago, 1994).

⁸ *The Correspondence of Charles Darwin*, ed. Frederick Burkhardt *et al.* (Cambridge, 1985-).

⁹ Howard Gruber, *Darwin on Man: A Psychological Study of Scientific Creativity*, with Paul Barrett (ed.), *Darwin's Early and Unpublished Notebooks* (London, 1974), 332, 333, 443.

world, a voyage into the past as exuberant as his voyage round the world in the *Beagle*.¹⁰ This double motion had much to do with the process of composition and its deep involvement over many years with Darwin's entire life. Despite his intellectual caution, Darwin retained and communicated in his writing the open vulnerability of the enthusiast.

Darwin saw himself during his youth as intellectually unremarkable. He began to study medicine at Edinburgh, left there, and went to Cambridge where he took the then-common pass BA. Even at that time he probably underestimated his proficiency, since he ranked tenth out of 178 candidates in the final examinations. Moreover, he had quite remarkably impressed the Professor of Botany, John Stevens Henslow, who spent much time with him and pursued questions he raised. Indeed, shortly after, Henslow transformed Darwin's life and future by recommending him (when the initial candidate dropped out) to Fitzroy, Captain of His Majesty's Ship, the *Beagle*, as captain's companion and natural historian. When Darwin set out on the *Beagle* he was not quite 23, about the same age as a present-day Ph.D. student. He was active, enthusiastic, inquisitive. The five years of the *Beagle* voyage were the transformative period of Darwin's life. During that time he undertook extensive journeys by land, often through little-known territory; he saw rapine and slaughter and the decimation of the Indians by the Spaniards, and of the aboriginal inhabitants of Van Diemen's Land by the British; he collected, preserved, and catalogued specimens of many kinds; he kept field-notes and a diary; he wrote frequent long letters home and to friends and fellow-scientists such as Henslow and Charles Lyell, the geologist.

Still considering himself to be a geologist despite the wide experience he was gaining in botany and zoology, Darwin made his first important theoretical intervention, establishing the difference between oceanic and continental islands, and, as he said, 'deductively', working out a new view on the formation of coral islands before he ever saw a reef. He learnt to look, to interpret, and, above all, to write and to use writing as part of the interpretive process. Through the interplay of sensory experience, record, collection, revision, reassessment, he gained the confidence to think theoretically, to risk large hypotheses, to subject them to close-grained instances without yielding them to a narrow empiricism.

¹⁰ The work we now call *The Voyage of the Beagle* was originally called *Journal of Researches into the Geology and Natural History of the Various Countries Visited by HMS Beagle* (London, 1839). It first appeared as the 3rd vol. of a *Narrative* controlled by Robert Fitzroy.

In recent years the tendency among historians of science has been to emphasize the 'belatedness' of Darwin's recognition of many of the materials he gathered, including the implications of his visit to the Galapagos. But this emphasis, though in its way sensible, can be needlessly exaggerated. It needs to be understood how the many phases of writing and revision, even while on board ship, played in with his physical exploration to generate thought. This interplay allowed him to reserve as well as to articulate, and to specify as well as to suspend ideas. He did not wait until he got home among his scientific peers to brood and, as he put it, 'build castles in the air'—a process which he declared to be quite 'as hard work as the closest train of reasoning in geology'.¹¹

The public outcome of this voyage has an important bearing on the later reception of the *Origin*. It helps to account for a phenomenon that has sometimes puzzled commentators: the very rapid recognition by his contemporaries of how Darwin's ideas bore on the descent of man, despite what he called his 'diplomatic' attempt to exclude it from the argument. When Darwin published the *Origin* he was not only a distinguished scientist but a well-known popular author. The work we now know as *The Voyage of the Beagle* had twenty years earlier had a remarkable success, rapidly moving from being the third volume of a narrative of voyages dominated by the authorship of Fitzroy to a free-standing publication which went into a second edition on its own. And the *Voyage* was full of accounts of the variety of indigenous peoples, their struggle for life, their imminent extinction, the disturbance in their social patterns as the result of colonizing invasion. Far from being purely a 'natural historical' account, if such an account excludes the human, Darwin offered a contribution to the debate then current concerning the place of ethnography in natural history. The debate was active at the British Association for the Advancement of Science in 1839, and Darwin was there made a member of a committee to draw up questionnaires for travellers who might contact remote peoples. In several instances in the *Voyage*, for example in his account of the Fuegians, Darwin emphasized the very close approximation between the human and the animal if physical conditions prevent anything but the round of minute-by-minute survival in adverse circumstances. Darwin, that is, was already well known as a vivid recorder of human as well as other kinds.

Why did more than twenty years elapse between Darwin's initial insights recorded in his notebooks in the late 1830s and the publication

¹¹ Gruber, *Darwin on Man*, 272.

of the *Origin*? The question can be answered at very different levels, not necessarily mutually exclusive of each other. Howard Gruber, and in his wake many others, has compellingly argued that Darwin resisted his own insight because of the social and familial upheaval it would bring upon him. Whether or not theology could, strictly, accommodate the new version of how things came to be, it would undoubtedly cause disturbance and grief to many believers, including his own wife. Moreover, Darwin's passionate attachment to his widowed father included also an Oedipal struggle which intermittently froze his activities. That is one strain of explanation proffered with twentieth-century hindsight.

Equally, more empirically minded commentators have emphasized the necessity for him to test his ideas against as many different kinds of evidence as he could gather. Hence, the argument goes, he needed the delay to augment the first-hand materials of the *Beagle* journey with others' reports and comments. And certainly the work as finally composed is studded with frequent and often generous reference to the works of others, especially Alphonse de Candolle, Edward Forbes, Asa Gray, Linnaeus, Charles Lyell, Geoffroy Saint-Hilaire, and now lesser-known contemporaries such as Kirby, Milne Edwards, Wollaston, and H. C. Watson. The section on hybridism draws directly and extensively on Köllreuter and Gärtner. Intriguingly, Malthus is mentioned twice only, and Wallace (though acknowledged in the introduction as having 'arrived at almost exactly the same general conclusions that I have on the origin of species') is also referred to twice only in the body of the work.

The work Darwin did during the 1840s on cirripedes was certainly not just a delaying tactic but a highly relevant investigation concerned with barnacles which exist on the borders of hermaphroditism, parasitism, and a two-sex system. They therefore raise fascinating questions of taxonomy and of reproductive systems, adaptation, and descent. (One can see to what good effect Darwin used such material in his argument in the *Origin* by turning to page 113 of this edition.) Darwin realized with mounting enthusiasm that cirripedes could be accurately studied *only* in the light of his new arguments. This implied empirical support for his theory: he wrote to Joseph Hooker in 1848:

I never shd. have made this out, had not my species theory convinced me, that an hermaphrodite species must pass into a bisexual species by insensible small stages, & here we have it, for the male organs in the hermaphrodite are beginning to fail, & independent males ready formed.¹²

¹² *Correspondence*, 4, p. 159.

So the years passed on, well spent in intellectual enquiry and experiment. Further, Darwin was not pressed for funds and was not in good health; the effort to bring his work to completion seemed less attractive than thorough, ongoing enquiry. The retired life he led at Down House did not bring to crisis any demand that he make his work public. Thus runs a third explanation.

Each of these interpretations is coherent, none is sufficient on its own, and—in their simplified form—none can quite include the extent to which Darwin *was* engaged in advancing and writing his own specific evolutionary programme during the intervening years. Darwin wrote two essays, one in 1842 and one in 1844, in which he first set out his ‘species work’. Though he judged both as insufficient sketches, he yet considered the 1844 essay sufficiently important to be published in case of his early death. In a formal letter to his wife he wrote:

... I have just finished my sketch of the species theory. If, as I believe, my theory in time be accepted even by one competent judge, it will be a considerable step in science.

I therefore write this in case of my sudden death, as my most solemn and last request, which I am sure you will consider the same as legally entered in my will, that you will devote £400 to its publication.¹³

Darwin knew that, for his theory to be fulfilled, it could not remain without an audience for ever. Despite his reluctance to publish (as he saw it, prematurely) he yet could not bear to think of his idea drowned in his own death. By 1844 he was confident that the theory was sufficiently watertight to be floated in his absence.

In the event, though, it was not until 1856 that he undertook the massive labour of sorting and collating his portfolios of notes and, under the urging of Charles Lyell, began the work now known as the ‘Big Book’—an immense study, *Natural Selection*, never to be finished. Instead, alarm over Wallace’s insights drove him to compose what he initially held to be another ‘sketch’, the *Origin of Species*. What started out as an ‘abstract’ (the ‘Big Book’ severely pruned and re-ordered) then opened out into new work written between August 1858 and September 1859 and published that November. The account by Adrian Desmond and James Moore in their *Darwin* (London, 1991) conveys a vivid impression of the clutter, the groaning of the spirit, the sickness, the impatience and anxiety, that went into this urgent composition. Without Wallace’s intervention it is possible that Darwin could have remained

¹³ *The Foundation of the Origin of Species: Two Essays written in 1842 and 1844* (*The Works of Charles Darwin*, ed. P. H. Barrett and R. B. Freeman, 10; London, 1986), p. xxi.

a Mr Casaubon, weltering in research grown old. Instead, the *Origin*, as *Middlemarch*'s author remarked shortly after its appearance, 'makes an epoch'.

It is important to remember that, at the time that Darwin was writing, the laws of genetics had not been established. The descent of characteristics and their distribution within a family, tribe, or species could be observed, but not technically accounted for. Gregor Mendel's 1866 paper on plant hybridism did not become generally known until 1900, well after Darwin's death. In the 1920s, population geneticists such as Ronald Fisher, J. B. S. Haldane, and Sewall Wright, put together Darwin's work on natural selection and Mendel's genetics to produce the 'modern' or 'neo-Darwinian' synthesis. That movement took Darwin's work forward into the present day, particularly in molecular genetics and the work that has flowed from the elucidation of DNA. With our hindsight the extraordinary importance of Darwin's thinking is manifest.

But what is it that accounts for the strength of the impact that Darwin's work had for his contemporaries, few of whom were during his lifetime convinced of the absolute centrality of natural selection as the central mechanism of evolutionary change? And how did he react to the criticisms mounted? Clearly his contemporaries were most disconcerted by the implications of his theory for religion—and this goes for many of the scientists among them, such as Lyell and Asa Gray, as well as professional clerics like the Bishop of Oxford, who neatly invoked traditional scientific methodology to bolster his theological criticisms: 'when subjected to the stern Baconian law of observation of facts, the theory breaks down utterly.'¹⁴

Despite Darwin's own later claims in his *Autobiography* that he had followed Baconian principles, such principles would have been quite inadequate to his purposes. Those purposes were to describe what could no longer be seen in the present world and to produce a history of what had vanished that would sufficiently explain what is now present. This could be accomplished at best by a process of backward induction (what Huxley called 'the method of Zadig') using what Darwin himself described as the slight fragments surviving:

For my part, following out Lyell's metaphor, I look at the natural geological record, as a history of the world imperfectly kept, and written in a

¹⁴ Quoted in Alvar Ellegård, *Darwin and the General Reader: The Reception of Darwin's Theory of Evolution in the British Periodical Press, 1859-1872* (Chicago, 1990), 186. From *Quarterly Review*, 108 (1860), 239.

changing dialect; of this history we possess the last volume alone, relating only to two or three countries. Of this volume, only here and there a short chapter has been preserved; and of each page, only here and there a few lines. Each word of the slowly-changing language, in which the history is supposed to be written, being more or less different in the interrupted succession of chapters, may represent the apparently abruptly changed forms of life, entombed in our consecutive, but widely separated, formations. (p. 229)

Darwin here and elsewhere used metaphors from language and from history. Indeed, his reading in language theory and in the new ideas of comparative grammarians and etymologists gave him a thought-model at a crucial time in the precipitation of his theories, as I have demonstrated elsewhere. In this passage he emphasizes the elements of time and of decay, and suggests how impossible it is to retrieve a full roster of evidence. Principles of change must serve. The living forms of the past studied in geology have been crumbled, striated, homogenized, ignited, compacted: rendered all but uninterpretable. Darwin implies an imagined synchronicity between writing the record and being part of the experience, as any historian must. But the passage also admits how fitful and slight is any access to the forms of the past. And now, in his own new and peculiar mind-world, far more was this so, since those forms have changed and changed again over aeons, and whole species have vanished and are vanishing. Darwin's theories demand recognition of loss, irrecoverable.

Darwin always denied that he was studying how life began. In his title he emphasized that he was concerned with process rather than stable origins, although the shortened version by which the book is commonly known today reverses that emphasis: *The Origin of Species* is less subtle than the full correct title, *On the Origin of Species by means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. 'By means of': a sequence of change is suggested in the main title, though stabilization is recognized in the subtitle with its keyword 'Preservation'. His position was very like that described by Foucault in 'Nietzsche, Genealogy, History':

Genealogy . . . depends on a vast accumulation of source material . . . and does not oppose itself to history as the lofty and profound gaze of the philosopher might compare to the molelike perspective of the scholar; on the contrary, it rejects the metahistorical deployment of ideal significations and indefinite teleologies. It opposes itself to the search for 'origins'.¹⁵

¹⁵ Michel Foucault (1971) in P. Rabinow (ed.), *The Foucault Reader* (London, 1984), 76-7.

Darwin studied the originating sequences, not the stable origin (if such existed). That paradox released him from the final task of challenging first causes, and yet usefully destabilized any insistence on design or plan.

Darwin placed three ideas in interaction to form his novel insight: those ideas were hyperproductivity, variability, and selection. The first two necessary ideas tend towards largesse: (1) superabundance of individuals and kinds; (2) variety potentiating a wide diversity of ecological niches. The third idea—selection—is more frugal. It drives ruthlessly across the populous ideal landscape of the first two, culling, controlling, weeding out. The tensions among these ideas are both indicative of Darwin's originality and damagingly difficult to keep in equal play. Perhaps in an attempt to do so, Darwin discriminated three forms of selection set oddly askance from each other: artificial selection, natural selection, and sexual selection. I shall return to these distinctions below.

Darwin's thinking drew fruitfully on nineteenth-century individualism in its insistence that the potentiality for change is borne by the individual, and that it is by means of the individual organism that evolutionary change comes about. Moreover, he wittily observed that 'it should be remembered that systematists are far from pleased at finding variability in important characters' and that variation was declared not to occur in 'important parts of the structure'. This circular argument had closed discussion because where variation did occur it was deemed that this was mere 'individual difference' in 'unimportant parts'. In contrast, Darwin asserted: 'These individual differences are highly important for us, as they afford materials for natural selection to accumulate' (p. 38); 'Hence I look at individual differences, though of small interest to the systematist, as of high importance for us, as being the first step towards such slight varieties as are barely thought worth recording in works on natural history' (p. 42). Such variability is the ground condition on which natural selection can fruitfully work; without such slight variations natural selection could make no headway. This emphasis on slight differences, deviations, rather than approximation to the parent-type, is among the most profound of Darwin's challenges to conventional thinking. Not the normative but difference proves to be the generative principle. Even now, in the light of the human genome project with its emphasis on normalization, that insight needs emphasis.

Before Darwin, J. B. Lamarck's 1815 theory of the descent of acquired characteristics, in *Histoire naturelle des animaux sans vertèbres*,