

because of the difficulty of researching such a diffuse area, there is a shortage of good analytical work on the contribution of the bicycle. It is bewildering, for example, that transport historians have not estimated the bicycle's importance in mobilizing the workforce, while industrial historians and historical geographers have scarcely considered the bicycle's contribution to the structure of industry, to employment patterns, and to the industrial landscape.

A significant exception but on a small scale is a lightly written account of the bicycle in its "golden age" by RUBINSTEIN. His scholarly and well-documented article looks at the extent, popularity, and social cachet of cycling in the 1890s and deals with constraints on the bicycle's use such as the quality of roads and the cost of purchase. It surveys the significance of a newly created personal mobility in relation to finding work, widening knowledge, and learning of new attitudes. There is much on the emancipation of women; "cycling", writes Rubinstein, "brought the sexes together on equal terms more completely than any previous sport or pastime". This article apart, a detailed and scholarly account of the clearly-important social and economic significance of the bicycle is still awaited.

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See also Road Transport; Transport Development

Biological Sciences

- Bowler, Peter J., *The Fontana History of the Environmental Sciences*, London: Fontana, 1992; as *The Norton History of The Environmental Sciences*, New York: Norton, 1993
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- Geison, Gerald L., *Michael Foster and the Cambridge School of Physiology: The Scientific Enterprise in Late Victorian Society*, Princeton, New Jersey: Princeton University Press, 1978
- Mayr, Ernst, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance*, Cambridge, Massachusetts: Belknap Press of Harvard University Press, 1982
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- Rehbock, Philip F., *The Philosophical Naturalists: Themes in Early Nineteenth-Century British Biology*, Madison: University of Wisconsin Press, 1983
- Richards, Robert J., *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior*, Chicago: University of Chicago Press, 1987
- Ruse, Michael, *Monad to Man: The Concept of Progress in Evolutionary Biology*, Cambridge, Massachusetts: Harvard University Press, 1996
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It is somewhat surprising that there is no single volume dedicated to the history of British biology since its genesis in the works of John Ray in the mid-1600s. Works such as NORDENSKIÖLD and MAYR can be usefully consulted by any reader who is willing to sift British from continental and American influences. These works are not without their problems. Nordenskiöld's volume suffers from a dismissal of the impact of Darwinian ideas, the study of which has preoccupied historians of biology since the centenary of the publication of the *Origin of Species* in 1959 and has led to the birth of what has become the "Darwin industry". As Peter Bowler has pointed out in a number of works, until the neo-Darwinian synthesis of the 1930s, biologists were effectively working within a non-Darwinian framework, which encompassed such ideas as neo-Lamarckism and orthogenesis, and Nordenskiöld cannot be faulted for his viewpoint as it was representative of the majority of working biologists during his time. Mayr, writing with hindsight as one of the architects of that synthesis, has a somewhat Whiggish internalist approach to the subject-matter, one which greatly contrasts with the approaches of the other works to be surveyed here. Much more satisfying is BOWLER's survey of the environmental sciences, which provides a study that nicely highlights the interdependency between the various branches of the natural sciences, eschewing the balkanization that is so typical of modern studies of scientific thought. Although not exclusively British in focus, this is an historical account that neatly melds the "history of ideas" and socio-cultural approaches to the historiography of science.

Given the general lack of surveys of British biology, the remainder of this review will highlight some of the more interesting specific studies. Many studies have largely concerned themselves with evolutionary thought, Darwinism, and the post-1950s genetic "revolution" midwifed by Francis Crick and James Watson. No attempt is made to provide the reader with an exhaustive account of available works - it will suffice to provide a sampler of some of the best scholarship in recent times. This scholarship has concentrated on the interfaces between Darwinism, evolutionary thought, biogeography, psychology, medicine, and natural history. In so doing, these works also highlight the increasing professionalization of the natural sciences during the past 200 years, with a subsequent increase in theoretical content and experimental sophistication.

In Britain, natural history first became a subject of serious scholarship in the late 17th century. Initial concerns were primarily taxonomic, and resulted in catalogues of what was seen as the Creator's work. REHBOCK documents how the developing science of biology entered a relatively quiet phase as it became obsessed with collection and classification, rather than explanation, resulting in a science that was largely devoid of theory. In his work devoted to early 19th-century biology, he demonstrates the influence of continental idealism (with its pattern-seeking tendencies) on such researchers as Robert Knox, Richard Owen, and Edward Forbes, and highlights the fact that many of these idealistic naturalists were Scottish or had an Edinburgh training. Further concentrating on the work of Forbes, Rehbock outlines the development of a second strand in pre-Darwinian British biology, that of "distribution studies", an area which, under the guidance of A.R. Wallace, would become biogeography as we know it today. Importantly, Rehbock notes that Darwin's theories stemmed in part from his

rejection of continental idealism and his interest in the flowering work on distribution.

In another work highlighting the influence of Scottish thinking, DESMOND illustrates the synergy between biology and evolutionary thinking in the development of medical teaching in London in the period before Darwin. In what is probably one of the premier examples of modern historiography of science, Desmond charts the development of nonconformist medical reformers who, while seeking to wrest medicine from the upper classes, imbued it with radical ideas such as transmutation and spontaneous generation. As is his style, Desmond highlights the political nature of the actions of many of the reformers, thus significantly expanding the study of scientific ideas within their social context.

GEISON takes the development of biomedical thinking a stage further in his landmark study of the physiologist Michael Foster and his work in developing physiology at Cambridge. As he shows, under the influence of continental ideas British physiology had stagnated in the mid-1800s, with primacy being given to anatomical and morphological studies, experimentation being largely undervalued. Along with Thomas Henry Huxley, Foster was responsible in the late Victorian period for the transformation of British biology into a science that was strongly experimental, exhibiting the scholarly apparatus of professional societies and the organs we see today. With this in place, biology became available as a formal degree in British universities, where it previously survived as elective coursework.

Such concerns about professionalization are further discussed in STRICK, whose examination of the debates on spontaneous generation and the origin of life offers a challenge to previously held notions within the history of microbiology. Strick demonstrates that, because of its earlier connection with radical politics, spontaneous generation was seen by Huxley and Darwin as an idea that would prevent the advancement of evolutionary biology as a part of the increasing cultural authority of science within Victorian society. To this end Huxley and others actively pursued a "Darwinian party line" that sought to exclude the theories of Henry Charlton Bastian, even though Bastian was a rising star among the young Darwinians.

Just as physiology, medicine, and microbiology became influenced by evolutionary ideas, the developing science of psychology became "Darwinized" in the latter part of the 19th century. In a work that has become the standard introduction to the study of the human mind in the Victorian period, RICHARDS shows how Darwin and Herbert Spencer felt that their evolutionary insights could be used to explain morality and ethics while refusing to negate their importance to the human species. In documenting the development of human psychology in the period after the publication of *The Descent of Man*, Richards shows how such biologists as George Romanes and St George Jackson Mivart wrestled with the implications of Darwinism for the status of the human mind. Interestingly, Richards himself utilises a Darwinian analysis of the history of ideas in his work, an approach that has received some criticism.

In a study that has generated some controversy among biologists and historians, RUSE has outlined the history of evolutionary biology, highlighting the underlying belief in social and biological progress apparent exhibited by biologists both today and in the past. Valuable for its thumbnail sketches of many figures (starting with Erasmus Darwin and ending

with the likes of John Maynard Smith), Ruse's work also nicely indicates how non-biological factors can influence the form of theories developed by scientists. It is, however, worth noting that in this and subsequent works Ruse stresses that he has little sympathy for the social constructivist school of science studies. He firmly believes that (evolutionary) biology has become more scientific and less socially influenced over the past 200 years.

As BOWLER perceptively points out in *Life's Splendid Drama*, historians of biology have largely concentrated on studying the debates centred on natural selection and heredity in the period between 1859 and 1940, while the most dominant project among practising evolutionary biologists during that same period was the reconstruction of the "tree of life" being undertaken by morphologists, palaeontologists, and biogeographers. In partly rectifying this skewed vision, Bowler has presented an often illuminating account of early 20th-century biology in Britain, as biologists manoeuvred to remove any taint of the perceived amateurism of old-fashioned field naturalism. In so doing, Bowler raises oft-omitted figures such as Edwin Ray Lankester into the spotlight. Lankester (like Huxley and Foster) was particularly involved in reforming biological education in light of the developing evolutionary and experimental paradigms, and indeed often sparred with Bastian. He remains a surprisingly neglected figure in the history of biology.

It comes as no surprise that biological studies within Ireland have received relatively little historiographical attention – as indeed has the history of Irish science in general. The collection of papers edited by FOSTER aims to remedy this, yet largely concerns itself with accounts of the major personalities within areas such as ornithology, mammalogy, and ichthyology. While the rich tradition of natural history within the island is highlighted, we receive little illumination as to the laboratory-based sciences that must have been occurring in Dublin (which was, after all, the second city of the empire).

As can be seen, the literature presented here can be woven into a somewhat continuous narrative that highlights the scientific and cultural context of the development of British biology, and the overall changes in interests and ideas. The reader seeking a single work that exhaustively examines these (and other) themes within British biology is currently searching in vain, and it can only be hoped that the coming years will see the publication of such a volume.

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See also Darwin; DNA and Genetics; Evolution Controversy; Huxley; Medicine entries; Spencer; Zoological Evolution and Classification

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