Studies in History and Philosophy of Biological and Biomedical Sciences 53 (2015) 16–39

Contents lists available at ScienceDirect

Studies in History and Philosophy of Biological and Biomedical Sciences

journal homepage: www.elsevier.com/locate/shpsc

Darbishire expands his vision of heredity from Mendelian genetics to inherited memory

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ARTICLE INFO

Article history:
Received 25 March 2014
Received in revised form
12 June 2015
Available online 14 July 2015

Keywords:
Memory
Vitalism
Darbishire
Butler
Bergson
Beethoven

ABSTRACT

The British biologist A.D. Darbishire (1879–1915) responded to the rediscovery in 1900 of Mendel's theory of heredity by testing it experimentally, first in Oxford, then in Manchester and London. He summarised his conclusions in a textbook 'Breeding and the Mendelian Discovery' (1911), in which he questioned whether Mendelism alone could explain all aspects of practical breeding experience. Already he had begun to think about an alternative theory to give greater emphasis to the widely held conviction among breeders regarding the inheritance of characteristics acquired during an individual's life. Redefining heredity in terms of a germ-plasm based biological memory, he used vocabulary drawn partly from sources outside conventional science, including the metaphysical/vitalistic writings of Samuel Butler and Henri Bergson. An evolving hereditary memory fitted well with the conception of breeding as a creative art aimed at greater economic efficiency. For evolution beyond human control he proposed a self-modifying process, claiming it to surpass in efficiency the chancy mechanism of natural selection proposed by Darwin. From his writings, including early chapters of an unfinished book entitled 'An Introduction to a Biology', we consider how he reached these concepts and how they relate to later advances in understanding the genome and the genetic programme.

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When citing this paper, please use the full journal title *Studies in History and Philosophy of Biological and Biomedical Sciences*

'You who speculate on the nature of things, I praise you not for knowing the processes which Nature ordinarily effects of herself, but rejoice if so be that you know the issue of such things as your mind conceives.' Leonardo da Vinci, quoted by A.D.Darbishire at his opening address to the Manchester University Biological Society for the session 1906–7: '*Some Conditions of Progress in Biological Enquiry*'.

1. Introduction

Gregor Mendel's theory of biological heredity, finally 'rediscovered' in 1900, represented a challenge for other breeders to test its validity. Arthur D. Darbishire (1879–1915), son of prominent Oxford medical man, was among the earliest. After attending Balliol College Oxford and graduating with honours in Natural Sciences (Zoology) in 1901, he spent two years in experimental research on inherited differences between varieties of mice under the direction of Professor W.F.R. Weldon, Head of Department (Darbishire, 1917, p. vii). A sequence of reports of the work published in the journal *Biometrika* attracted interest from William Bateson, Fellow of St John's College Cambridge, prompting an exchange of letters. The correspondence continued after Darbishire had moved to Manchester in 1903, as Senior Demonstrator and Assistant Lecturer in Zoology at Owen's College, with continuing patronage from Weldon. The future looked bright for him. Yet within a few months he would lose the confidence of Bateson and face alienation from Weldon due to the contents of his reports, particularly the fourth and final one published after the move.

The course of events was brought to light and analysed by William Provine (Provine, 1971), and has since become 'a classic case study…used to show the social construction and relativity in science' (Ankeny, 2000). In the background of the Bateson/Darbishire exchange of letters, a conflict was raging between two groups

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http://dx.doi.org/10.1016/j.shpsc.2015.06.001
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of biologists, the 'Mendelians' and the 'Galtonians', about the nature of heredity. The first group investigated inherited variation in crosses between varieties showing clearly defined characters, open to analysis according to the theory proposed by Mendel, which was being strongly championed and expanded by Bateson. The other group, to which Weldon was aligned, were the followers of Francis Galton, a cousin of Charles Darwin, who had inspired a small but gifted group of mathematically minded biologists, known as 'biometricians', to develop a rigorous statistical approach to analysing variation and quantifying degrees of relationship. The biometrician aimed to approach biological variation as an 'unbiased observer', viewing it 'mechanically' [for the use of this terminology see a letter from Bateson to Yule, 28th Nov 1922, quoted below] rather than as a series of subjectively divided categories, in the manner of Mendel's 'contrasting characters'. For Darbishire the problem was to decide which theory best fitted his experimental data.

It is not the purpose here to retell the story of this academic controversy, except in passing, but rather to trace Darbishire's reaction to it during the following twelve years, the rest of his life in fact. While he was never to join the exclusive ranks of fully committed Mendelians, he was happy to recognise the predictive capacity of the theory in certain well defined cases. In a book, *Breeding and the Mendelian Discovery* (Darbishire, 1911b), he presented evidence for Mendelism. At the same time, however, he could not allow himself to bypass some unanswered questions about breeding and evolution unresolved by the theory. Even as the book was published he was considering a second biological work based on the concept of unconscious inherited memory, strongly inspired by the writings of Samuel Butler. Later he incorporated ideas also from Henri Bergson. Under the influence mainly of these two authors he sought answers to fundamental aspects of life for which Mendelism seemed peripheral.

What follows will, I trust, be of interest to specialist historians of early Mendelism. But the Darbishire story, as reconstructed here, promises to throw light on at least three issues of wider interest. The first concerns the design of biological experiments, interpreting their outcome and resolving contradictions. The second relates to factors outside science that may condition the emergence of a novel scientific concept. The third reflects upon the career choice facing a scientist engaged in undergraduate degree teaching whose current line of research is questioning an aspect of scientific orthodoxy, fundamental to his/her institution's academic programme as a whole.

2. Early life, studies and research

To prepare the ground we shall look into Darbishire's background up to the age of twenty two when he began his experimental research. Born into a prosperous middle class family he had much for which to be thankful although a strong physical constitution was not one of them. His life was marred by ill health stemming from a childhood infection with rheumatic fever, leaving him with bouts of exhausting symptoms. Whereas under normal circumstances he would have attended boarding school, he was instead taught privately by a governess at home with his two sisters, first in Oxford, later in Dwgyfychi (Penmaenmawr), North Wales where he formed a deep attachment to poetry, art and above all music, and gained extensive knowledge of the German language (Anonymous, 1919, 1924; Darbishire, 1906b; Tillotson, 1924). The breadth of his exposure to science is not known except for topics nourishing his lifelong interest in technical aspects of gardening and farming (preface by Helen Darbishire, 1916 in Darbishire, 1917, p. xi) or which encouraged him, under his father's influence, to take a functional view of anatomical variation. Dr. Samuel D. Darbishire, forced by his own failing health to retire to North Wales from practice in Oxford, retained a lifelong interest in the muscles used in rowing, on which he had projected a book (Gibson, A.G. 1926, pp.148–149).

With the father's death in 1892, the family moved back to Oxford where Darbishire, aged 13, had his first taste of formal education at Magdalen College School, in preparation for Oxford University entrance. The preparation proved inadequate, however, for having followed his father to Balliol College in 1897, he found himself unable to pass the first year examination ('Prelims'). He was allowed to retain a place only through the intervention of a fellow student, Harold Hartley (destined to become an outstanding physical chemist) who, in recognition of the cheerful good nature and sparkling wit of his friend, agreed to coach him (Hartley, 1969). Fortunately for Darbishire, Hartley provided just the extra knowledge needed for his pupil to 'romp through' when re-examined.

He took to zoology with evident enthusiasm, eager to give illustrated talks on aspects of the subject to the Oxford University Junior Scientific Club, special enough to gain a mention in the journal *Nature.* One on 'Natural Selection among Lepidoptera', was 'illustrated by several cases of butterflies' (*Nature* Nov. 24 1898, p.93). On another occasion he was reported to have demonstrated 'a number of living crustaceae (sic) by microscopic projection onto a transparent screen' (*Nature* June 14 1900, p.165). With regard to his lecturing, his sister Helen remarked that 'he had the instincts of an actor and a good deal of the art'. (Helen Darbishire, 1916 in Darbishire, 1917, p. xi).

As Weldon's research assistant, Darbishire was linked with 'one of the leading biologists of that time' (Punnett, 1950) who had designed a set of experiments to test the hereditary theory of the botanist Mendel with respect to an animal. The choice had fallen on the house mouse *Mus musculus*, varieties of which Weldon had kept for nearly a year to establish their 'purity' (Pearson, 1906-7. p.41). The project got under way in the early autumn of 1901, in preparation for which Darbishire lectured on Mendel's discovery to the Junior Scientific Club. It was an occasion given added significance in the history of genetics by the presence in his audience of the eight year old J.B.S. Haldane, a future giant of genetic theory, brought along to the lecture by his father, the Oxford physiologist J. S. Haldane (Clark, 1968, pp.29–31). Darbishire's skill in interpreting the new vision of heredity, with its unfamiliar terminology, depended critically on his knowledge of German, there being no translation of Mendel's paper into English published at that time.

Enthusiastic to discover whether the subject of his lecture had any relevance to animals, Darbishire wasted no time in producing results from the projected experiments, rewarding Weldon with a mass of mouse breeding data to be analysed and published in the journal *Biometrika* in four reports, illustrated by the author with pen-and- ink drawings of the variations observed (Darbishire, 1902, 1902–1903a, 1902–1903b, 1904a). All the reports were published in Darbishire's name alone, with acknowledgement given in the final (summary) paper to Weldon for 'helping to bridge over a gap due to my absence from Oxford for two months' [due to a bout of Darbishire's illness?] and for giving 'me assistance in tabulating the conclusions', to Karl Pearson at University College, London 'for giving aid in the calculation of the correlation coefficients, and in criticisms of some of the conclusions drawn from them', 'to my friend E.H.J. Schuster [another of Weldon's students, also making experimental crosses with mice (Schuster, 1905), later to become an authority on the application of statistics in biology (Huxley, J. 1972, p. 61)] for much arithmetical help very generously given', and to Weldon's Senior Assistant, Mr Frank Sherlock for helping to maintain 'in a sanitary condition…some fifteen hundred mice' in the Oxford breeding room… 'a debt of gratitude which it difficult to express' (Darbishire, 1904a, p.28). Clearly the project was a team effort. In fact Pearson, editor of *Biometrika*, gained the impression that Weldon had been more involved than Darbishire was required to acknowledge: 'the whole plan of the experiments, the preparation of the correlation tables, and the elaborate calculations were in main due to Weldon', he wrote (Pearson, 1906–1907). Even so there

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