

suggest that this was the period and the place that 'the medical invention of sex' took place is obviously not true. Aristotle himself (not mentioned) had a great deal to say on the subject two thousand years beforehand. He accurately described the basic differences in anatomy and behaviour between men and women, the consequences of male and female castration in a variety of animals, and made some amazingly perceptive deductions about the role of the fetal gonads in sexual differentiation.

Dreger's review stops short before the endocrinology of sexual differentiation was understood. Thus, the concept of sexual differentiation of the brain, which probably lies at the heart of our self-perception of gender, is never mentioned. And although Dreger bemoans the lack of personal accounts of what it was like to be an intersex in former times, she never mentions Jan Morris's contemporary account (*Conundrum*) of what it is like to have married, fathered children and climbed Mt Everest, only later in life to have the courage to revert to womanhood, or Peter Stirling's account (*So Different*) of what it is like to have married and given birth to a child before deciding to change to manhood. Are these errors of commission, or omission?

Dreger's book opens with an introductory chapter on Doubtful Sex, with veiled innuendoes about the sexist prejudices of 'medical and scientific men' who have worked in this area. This is but a foretaste of the polemical Epilogue, which affirms that ... 'postmodernism, in its appreciation of the social construction of concepts like sexual identity and normality, has given intersexuals the opportunity to see their plight as contingent to social times and places – to see their experiences as culturally, historically specific and therefore not inherent in or necessary to their bodies' (emphasis mine). But *Brain Sex* demonstrates that sexual identity is *not* all about Nurture; Nature can override it, as is beautifully shown by the case of the French hermaphrodite, Herculine Barbin, cited by Dreger at the beginning of her book.

Lacking any understanding of endocrinology, it is no wonder that doctors in the past were primarily concerned with gonadal sex – something they could see or feel which predicted the type of sex hormones that the gonad would produce, and with genital sex, which is how the community at large judges whether we are male or female, an either-or situation. But Dreger rightly draws attention to the shortcomings of this purely anatomical classification, which takes no account of the individual's own perception of their gender. Perhaps it is time to acknowledge the fact that whilst the law defines but two sexes, there are probably four genders – male and female heterosexual, and male and female homosexual. It is when sex and gender are not congruent that conflicts arise in the individual and in society at large.

Even in recent times, doctors, in their

ignorance, have made some ghastly mistakes. In the middle of this century, an American baby accidentally had the tip of his penis amputated during circumcision, and the doctors ordered complete penile amputation, castration, reconstruction of the scrotum into a vagina, and gender reassignment. The case is recounted by John Money, and is often cited as an example of the lability of gender if reassignment occurs early in life. Alas, the subsequent tragic history of this unfortunate boy shows that his brain sex remained immutably male. Dreger asserts that 'virtually all American intersex doctors argue that an XY child born at term with a phallus length less than 2.5 centimetres (when stretched) is better off being made into a girl'. If this is true, it is indeed scandalous.

So what are we to make of Dreger's book, a brief history of intersexuality in Britain and France around the beginning of the 20th century? As Maréchal Bosquet said of the Charge of the Light Brigade, '*c'est magnifique, mais, ce n'est pas la guerre*'.

R.V. Short

Darwinism's Struggle for Survival: Heredity and the Hypothesis of Natural Selection

by J. Gayon

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This is Matthew Cobb's welcome translation of French philosopher Jean Gayon's *Darwin et l'après-Darwin: Une histoire de l'hypothèse de sélection naturelle*, originally published in 1992 in Paris by Editions KIMÉ. The new 'Preface to the English Edition' reveals the history and goals of this book. It begins with the recognition of France's lagging interest in Darwinian evolution and its history (a fact long known to historians), which seems only to whet Gayon's appetite for the subject. Gayon

converted to the philosophy and history of evolutionary genetics after realizing that what French biologists 'grandly' termed the 'synthetic theory of evolution', was in fact *not* regarded by them as a 'scientific theory' (p. xiii). Gayon subsequently turned to the history of science to identify 'the structure of this theory, and to trace its genesis' (p. xiv). An initial examination of mostly American archival sources (the papers of Theodosius Dobzhansky, Ernst Mayr, G.G. Simpson, etc.) and conversations with American population geneticists like R.C. Lewontin subsequently led him to the view that the synthetic theory was the result of the 'determined work of a group of American biologists' who, during the Second World War, 'had decided to make their disciplines coexist and their doctrines congruent, dividing up the work in a typically American way.' The 'great intellectual adventure', as he states ruefully, 'seemed more to be an episode of sociology. A genuine historian would have been happy. This philosopher was deeply disappointed' (p. xiv).

Hence this book, which is a philosopher's attempt to write not only an 'internal and conceptual history', but a 'logicist version' (history of science driven by the internal logic) of Darwinian evolution, without the sociological — or social — complexities which he leaves to be filled in by social histories of science (here Gayon confuses sociology of science with social history of science) (p. xv). As such, the book is a philosophical rather than a historical work, relying on published rather than archival records and does not offer much in the way of general historical interpretation or explanation. It is not, therefore, by its own design directed towards the central concerns of historians, though it will be of interest to those with a keen interest in philosophy and evolutionary biology.

The book's structure hinges on a strange distinction between hypothesis and theory in Darwin's central mechanism of natural selection. Picking up on a little-recognized section in Darwin's 1875 edition of *The Variation of Animals and Plants under Domestication*, Gayon separates the theory of natural selection from the hypothesis of natural selection, a distinction he states Darwin himself supported. Unlike the theory of natural selection, which was articulated in *Origin* and which served successfully to unify natural history, the hypothesis of natural selection as articulated in 1875 was less successful since it failed to explain the interplay between selection and the key terms of variation and heredity. The distinction is crucial to Gayon's book, which does not focus on the larger theory, but instead traces the hypothesis of natural selection beginning with Darwin through the tumultuous period around 1900 termed by Julian Huxley as 'The Eclipse of Darwin', and ending with the work of the mathematical population geneticists who laid the foundations of the 'synthetic theory' by establishing

the legitimacy of the genetical theory of natural selection, once and for all. The book is thus not a history of evolutionary biology or of evolutionary theory, but instead a philosophical examination of the fate of Darwin's 'hypothesis of natural selection' and how heredity was accommodated eventually by the hypothesis.

The distinction is not only confusing – and made more confusing still by terms like 'theoretical Darwinism', and 'evolutionary thought' (all sometimes used interchangeably) – but is also responsible for the major shortcoming of the book: the nearly complete omission of all areas bearing on the theory, i.e. biogeography, systematics, paleontology and ecology (the areas traditionally associated with natural history), in addition to morphology and embryology and other areas. This is a painful limitation imposed by the structure of the book, especially given the recent rich work exploring the history of these long-neglected areas (for one fruitful recent example concentrating on morphology during the same interval of time see Peter Bowler's *Life's Splendid Drama*, University of Chicago Press, 1996). Hence, Gayon's coverage of intellectual events leading to the 'Eclipse of Darwin' – the important aim of the book (p. 3) – includes no serious discussion of orthogenesis (and other forms of 'directed' evolution) or neo-Lamarckism, all of which were popular alternatives to natural selection for paleontologists, systematists and naturalists at the turn of the century (the index sends readers interested in neo-Lamarckism to the introduction, one footnote, and a final two-page section described as 'from viewpoint of population genetics'). Although a closing section explains how reasoning in population genetics 'dissolved' the 'mirage' of such 'doctrinaire positions' (p. 322), the reader is not given to understand what exactly those positions entailed or why they were so popular at the turn of the century.

The book is organized in three parts. The first explores 'The Darwinian Hypothesis', in detail by looking at not only *Origin*, but also Darwin's subsequent work, especially *The Variation of Animals and Plants under Domestication*. Gayon does a splendid job here of exploring the meanings and logical interplay of key terms like variation and heredity in addition to artificial and natural selection. Gayon includes a detailed exploration of differences between Darwin and Alfred Russel Wallace, who did the most to originate and promote natural selection. Whereas Darwin gave a central role to heredity, which he enhanced through examples of artificial selection, Wallace did not include heredity in his theory and disagreed with Darwin's reliance and emphasis on artificial selection. Here, Gayon points out that Darwin included breeder's insights, which naturalists like Wallace thought irrelevant. As a result, both converged on understanding of natural selection from opposite directions: Darwin from consideration of

the heritability of individual differences resulting from competition in a sort of bottom-up approach, whereas Wallace took a top-down approach from consideration of competition between varieties and species. Fundamental differences over what was subsequently termed the unit or level of selection led to the well-known disagreement between Darwin and Wallace over sexual selection. Here, Gayon's discussion of the history of sexual selection complements nicely the work of philosopher Helena Cronin in *The Ant and Peacock* (Cambridge University Press, 1991).

Although Gayon's discussion of the differences between Darwin and Wallace is lucid, it also suffers from the self-imposed limitations of the book. The narrow focus on the hypothesis of natural selection serves to exclude – by definition – the rich contributions of naturalists like Wallace. As a result, Darwin, who budgeted for heredity and who set up the 'hypothesis' comes across once again as the figure with the great insights, while Wallace, who launched a biogeographical revolution gets regrettably shortchanged. The historical Wallace is in fact barely recognizable in this philosophically-driven historical discussion.

The first part of the book also includes one of the best chapters of the entire work, dealing with a serious examination of Fleeming Jenkin's review of *Origin*. Here we finally come to understand Jenkin's complex critique: no longer is the feud between Darwin and Jenkin merely about the 'swamping effect' of blending instead of particulate inheritance, but also involves Darwin's lack of a truly populational and biometrical consideration of varieties and species. This critique of *Origin*, which was nearly devastating (Darwin took this critic most seriously), foreshadowed the subsequent drive to create a statistical theory of natural selection. More than any other chapter, it lays the groundwork for comprehending the tortuous history of the 'hypothesis of natural selection.'

The second and third parts deal with the 'sixty years of principled crisis' as 'selection faced the challenge of heredity' and the establishment of 'the genetical theory of selection.' Here Gayon charts well-worked areas including the rise of the biometrical school, the biometrician–Mendelian debate, the establishment of early mathematical formulations like the Hardy–Weinberg Equilibrium, and finally the establishment of the mathematical models of theoretical population geneticists R.A. Fisher, Sewall Wright and J.B.S. Haldane. It is familiar terrain, but Gayon is to be commended for his careful explication, especially of subjects like Galton's 'Law of Ancestral Heredity.' Most welcome is his inclusion of the French contributions to population genetics by Maxime Lamotte, Philippe L'Héretier and Georges Tiessier, and the final section bringing the reader through to Motoo Kimura's contentious 'neutral theory of evolution', which becomes much less

contentious under Gayon's deft explication.

Gayon concludes his book by bringing what he terms the 'formal aspect' of theoretical population genetics to grounding in the empirical world. Earlier, a similar attempt is made in an all-too-brief chapter on mimicry; but after nearly 400 pages of detailed explication of work leading to the 'formal aspect', this becomes only an attempt to pay respects to the other half of evolutionary biology. This is sure to disappoint a large segment of evolutionary biologists who will instantly see the absence of key subjects like the struggle to understand mechanisms of speciation.

Both biologists and historians will also be disappointed to see the 'evolutionary synthesis' (the preferred historian's term instead of synthetic theory) avoided, sociological warts and all. Ernst Mayr, Julian Huxley and even Theodosius Dobzhansky get only cameo roles, while G.G. Simpson and G.L. Stebbins — two of the architects of the evolutionary synthesis — are not even noted in the index. The cryptic comments in the preface, the unyielding commitment to 'logician' history, and the all-too frequent references to 'mere ideology' or 'mere rhetoric' only serve to whet the historian's appetite (Gayon is certainly right about that): what exactly *does* Gayon mean by the synthesis as 'an episode of sociology'? Are we led to infer that the synthesis was an American consensus-building conspiracy devoid of cognitive legitimacy? Gayon leaves this enormous knot untangled.

Much of the criticism concerning the exclusion of vital elements could have been avoided easily by a simple reframing of the book's structural premise and a more precise title describing the ground richly covered by this book — the history of theoretical population genetics. Despite the historiographic criticisms, the technical explication remains superb. Our understanding of the philosophical twists and turns leading to the origins of theoretical population genetics is enhanced and the book will surely serve as a much-consulted reference work. Gayon here gives a virtuoso performance, even if much of the score was written by predecessors.

V.B. Smocovitis

Deciphering Global Epidemics

by A. Cliff, P. Haggert and M. Smallman-Raynor

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Disease surveillance data abound. The UK has over 30 notifiable human diseases, the USA has over 50, and for many of these records go back more than a century. Data of this kind should be a cornerstone of modern epidemiology and yet, with a few notable exceptions of which more later, surveillance records are a greatly