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Essay review

Broadening heredity

Stacffan Müller-Wille, Christina Brandt. (Eds.), Heredity Explored: Between Public Domain and Experimental Science, 1850–1930, MIT Press, Cambridge, MA (2016). 480pp. Price $49.00 £40.95 hardcover

Life Histories of Genetic Disease: Patterns and Prevention in Postwar Medical Genetics, Andrew Hogan. Johns Hopkins University Press, Baltimore, MD (2016). 280 pp. Price $40.00 hardback, ISBN: 9781421420745

Two revolutionary transitions have long provided the landmarks in our navigations of the history of the scientific study of hereditary phenomena. First, following the 1900 triple-rediscovery of Gregor Mendel's experimental breeding work with the garden pea, *Pisum sativum*, performed in the 1860s, heredity, how it was conceived and how it was investigated, became thoroughly Mendelised. Mendelism, with its discrete segregating factors transmitted according to predictable and verifiable rules, promptly displaced the speculative theories of the latter nineteenth-century; those associated with Charles Darwin, Francis Galton, August Weismann, and Hugo de Vries, for example. Mendelism also provided the foundation for the new science of genetics, a powerful discipline which studied the transmission of traits from one generation to the other via the passing on of Mendelian factors—re-christened "genes" (Johannsen, 1909). Genetics in the Mendelian mode went along happily and with many great successes through the first decades of the twentieth-century, a period during which its findings infiltrated many fields, from biology and medicine to psychology. They were also synthesised with Darwinian natural selection to yield the theoretical orthodoxy which to a large extent continues to underpin evolutionary studies today.

After World War II, though, revolution was once again in the air. With Watson and Crick's 1953 discovery of the double-helical structure of DNA, and biology's rapid uptake of tools, techniques, and even personnel from the physical sciences, the scientific study of heredity was rapidly and irreversibly molecularised. Andrew Hogan's *Life Histories of Genetic Disease* covers exactly the period of this transformation, and in one of the key contexts—medical genetics—in which the ramifications of this molecular revolution were supposedly most keenly felt. Staffan Müller-Wille and Christina Brandt's edited volume *Heredity Produced*, on the other hand, spans neatly the moment of the vaunted Mendelian break, setting up nicely the prospect of a "before-and-after-the-triple-rediscovery" type comparison.

All of this is to say that one might expect to be on familiar grounds with these volumes, each respectively updating and supplementing our pictures of these consequential ruptures in the history of a discipline. One would be mistaken. In fact, each work offers a 'smearing-out' of the sharp breaks which have been supposed to have occurred in the periods they address. Notions of continuity, heterogeneity, and the ongoing negotiation between old and new, challenge received narratives of sudden and decisive transformations in concepts and practices. In this essay I offer a necessarily incomplete survey of how each volume exercises these remedial aims, before exploring a couple of themes which might frame future investigation in lieu of the narratives which the present works challenge.

1. Getting the monk off our backs

Heredity Explored is the latest of the Max Planck Institute's long-term "A Cultural History of Heredity" project. Its predecessor *Heredity Produced: At the Crossroads of Biology, Politics and Culture, 1500–1870* (Müller-Wille & Rheinberger, 2007), detailed the complex story of the emergence of "heredity" as a biological concept. The roughly eight decades from 1850 to 1930 which the newest volume covers were, as its title suggests, ones during which thinking about the heredity was developed in a variety of directions, by a heterogeneous host of people in diverse contexts,[1] towards disparate ends. As already suggested, this angle may surprise readers expecting attention to this period to generate a story of *consolidation* of both the realm of heredity's proper investigation—i.e. the emergence of the new science of genetics— and of the notion of biological inheritance as being *hard*, *particulate*, and above all *Mendelian*. Yet in their synthetic introduction, the editors make clear their intention, "in contrast to previous scholarship, [to] go beyond the focus on Mendel's rediscovery" (Müller-Wille & Brandt, 2016, p. 5). *Heredity Explored* emphasises the variety of people—physicians, publics, agriculturalists, gynaecologists—and contexts—medical, agro-industrial, policy, literary—involved in the formulation of ideas about heredity, as well as the heterogeneity and flexibility of the ideas themselves. For the cast of characters in many of the cases examined, fitting Mendelism into the post-1900 picture was far from unproblematic, and required considerable conceptual acrobatics, if it was to be attempted at all. Thus, at least with respect to Mendelism and its place within hereditary discourse, *Heredity Explored* paints a picture of relative continuity across the turn of the century, and of the significant negotiations required in reconciling seemingly discordant conceptual resources. As such, this ambitious volume challenges us not only to broaden our conception of what heredity *qua* biological concept has meant throughout its relatively short

[1] The editors utilise these various contexts in organising the volume into thematic sections: 'Geneaology, Kinship, and Population'; Heredity, Evolution, and Reproduction'; Heredity in Agro-Industrial Contexts'; Heredity in Medical Contexts'; 'Mendelism'.

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history, but also to widen the scope of the hows and whys of engaging with heredity as a historiographical object.

As intimated by its qualifying subtitle, the collection demonstrates that what was going on in the new laboratories of genetics was only one part of a rich story played out in diverse cultural realms. Historians must hold this in mind when hoping to piece together the history of heredity. The varied contributions to this volume, dealing with asylums, vaccines, marriage laws, and the literary figure of the bachelor, in addition to more established topics like genetics research and evolutionary theory, well exemplify this broadening of the scope of where to look when we do the history of heredity. Though still centred on Europe and North America, the perspective achieved in this volume is still far wider than that of any previous work on heredity in this period, and it is much the better for it. In stepping outside of Mendel's pea garden or Morgan's fly room at Columbia, and into the Copenhagen Carlsberg Laboratory—Christophe Bonneuil, chapter 9 on "Pure Lines as Industrial Simulacra"— or the record offices of state Asylums—Theodore Porter, chapter 4 on "Asylums of Hereditary Research in the Efficient Modern State", the conceptual and cultural richness of the story of heredity is brought home. Something which bleeds through many of the contributed essays is the notion that investigations of heredity were often far from efforts to merely *explore* it, but also to *control* it. Whether their ends were eugenic, medical, industrial, agricultural or otherwise, the historical cast of *Heredity Explored* were generally intent upon not just understanding, but also influencing and managing the transmission of biological and behavioural traits. As Bonneuil's essay demonstrates, for industrialist-breeders dealing in plant lines for food production, the purity of stocks and the reliable recurrence of desirable traits were serious business and key to their marketability; J. Andrew Mendelsohn's chapter "Message in a Bottle: Vaccines and the Nature of Heredity after 1880" shows that the same was the case for the mass-production of standardised vaccinations.

It was in these so called "agro-industrial" contexts that Wilhelm Johannsen formulated his notion of the "pure line" and his 1909 genotype/phenotype distinction, effectively driving a wedge between heredity on the one hand and development on the other. Towards the aims of mass-producing serialised and stable lines of biological individuals, the abstraction of heredity from individual ontogeny and historical contingency was a productive move. Such was not necessarily the case in other contexts, notably the medical one. Jean-Paul Gaudillière and Ilana Löwy, in their chapter on "The Hereditary Transmission of Human Pathologies between 1910 and 1940," show that Mendelism, which rapidly became deeply linked to Johannsen's distinction, received a rather cool reception in some British, French and American medical circles. Whilst the abstraction of inheritance away from individual ontogeny was amenable to the aims, methods, and large populations of the industrialists and breeders, such was not necessarily the case for physicians dealing with the pathologised or aberrant individual. As the volume's editors nicely put it, "as far as the epidemiology of disease is concerned, questions of infection, immunization, and heredity remained confounded in such a way that the vertical and the horizontal dimensions of the transmission of diseases could not be disentangled" (p. 12). The inheritance of diseases or propensities to develop them seemed a much more complex affair than the passing down of discrete factors in accordance with Mendel's newly rediscovered laws, and one in which environment, ancestry, and a host of contingent factors were seen to play irreducible roles. Gaudillière and Löwy conclude that, although physicians were aware of the successes of laboratory Mendelism, many questioned its relevance to their own pursuits. Bernd Gausemeier, in his chapter (14) on populational studies of pathological heredity, explains that although many practitioners were explicitly committed to the notion of Mendelian unit factors, "their discourse remained widely shaped by older concepts of ancestral "influence" and familial bloodlines" (p. 353). As the work of Jonathan Harwood (2015) and others have done for breeding practices, this picture challenges the notion of a sharp break or rapid uptake of Mendelism in medicine in the first decades of the twentieth-century. The feeling we get from the contributions to *Heredity Explored* more generally is that, to the extent that Mendelism *was* incorporated into existing conceptual and experimental practices, its place therein was fragile and subject to significant negotiation.

2. More than molecules

By the time we reach the postwar setting of Andrew Hogan's *Life Histories of Genetic Disease,* medical thinking on heritable disease had been thoroughly Mendelised. The standard "break" narrative which provide's one of Hogan's foils is not the Mendelian revolution, but the "molecular" one. Several scholars, Hogan tells us, have proposed a schism to have occurred in postwar medical genetics, after which biomedical practitioners 'visualized life at the molecular level … replacing the clinical gaze of medicine with a new style of thought and way of seeing … the "molecular gaze"' (p. 208). Hogan's revised and compelling picture is one in which

> the era between the 1970s and the present did not reflect a transition from one style of thought to another—from the clinical gaze to the molecular gaze—but rather the ongoing development of a genomic gaze, which incorporated both (p. 210).

Thus, what Hogan calls the "chromosomal infrastructure" (p. x) built up through cytogenetical research in concert with clinical investigation was not discarded wholesale with the rise of molecular sequencing and other techniques. The vision of the genome embodied in chromosomal ideograms of the 1950s with their familiar banding patterns remained a touchstone for medical geneticist, who endeavoured not to displace but to integrate the wave of DNA-sequence information with this older picture. The continued emphasis on the *chromosome* in what was supposedly the age of the *gene* resonates with Luis Campos and Alexander von Schwerin's contribution to *Heredity Explored*. Their essay on "Transatlantic Mutants" explores how Albert Francis Blakeslee and Erwin Baur, whose broadly Mendelian work focused, respectively, upon mutations at levels "above"—i.e., chromosomes—and "below"—*Kleinmutationen*— that of the classical gene.

Hogan paints his picture through an impressively detailed and engaging reconstruction of how it is that physicians and geneticists in the postwar period came to define genetic diseases, correlate them with particular genetic abnormalities, and detect and visualise these abnormalities in patients in the context of prenatal diagnostics. With this in mind, the title he has chosen for his book plays fruitfully and self-consciously upon a double-meaning. Medical folk speak of genetic diseases as having "life histories" in the sense of an identifiable developmental pattern in the presentation of traits, tendencies and symptoms throughout each individual patient's lifetime, with room for some variation, of course. But they were also well aware that the diseases they dealt with have conceptual life histories of their own. That is, understandings of disorders, within the profession and without, evolve through time in response to changing ideas about their causes, diagnosis, and proper treatment. Hogan's narrative is driven by, and in turn buttresses, the notion that disease concepts are responsive to, and actively constructed by, human intervention.

Hogan brings this point home starkly in his fifth chapter, which explores an instance in which two disorders—DiGeorge syndrome and velo-cardial-facial (VCF) syndrome— previously thought to be distinct, were lumped together. Medical scientists' rationale for this move was the successful application of a novel mapping technique imported from molecular biology, namely, *in situ* hybridisation, in the identification of a chromosomal mutation shared by patients diagnosed with either syndrome. One of Hogan's major protagonists, the medical geneticist and author of the influential *Mendelian Inheritance in Man*, Victor McKusick, complained that clinical observations of patients could be misleading; manifestations of similar sets of symptoms were often and erroneously taken to represent instances of the same disorder. What mattered in delineating these