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Essay Review

Utopian biologies

Helen Anne Curry, *Evolution Made to Order: Plant Breeding and Technological Innovation in Twentieth-Century America*. Chicago: The University of Chicago Press, 2016. Pp. 285. ISBN 978-0-226-39008-6. $45.00 (cloth).

Ewa Barbara Luczak, *Breeding and Eugenics in the American Literary Imagination: Heredity Rules in the Twentieth Century*. New York: Palgrave, 2015. Pp. 275. ISBN 978-1-137-54578-7. £58.00 (hardcover).

In 1924, the British biologist J.B.S. Haldane acknowledged that anyone who tried to predict where science was taking us was obliged to mention H.G. Wells, since '[t]he very mention of the future suggests him'. Nevertheless, Haldane complained that Wells was 'a generation behind the time', having been raised when flying and radio-telegraphy were genuinely scientific questions, but they were now mere 'commercial problems', Haldane asserted, and 'I believe that the centre of scientific interest lies in biology'.[1] Haldane's conviction that biology was the key to the future was widely shared, and lies in the background of both these books. Helen Curry examines the early history of the dream of engineering new kinds of plants, using first X-rays, then colchicine (a chemical mutagen), and then the new sources of intense radioactivity that were created by the early nuclear reactors. By contrast, Ewa Luczak is interested in the influence of eugenics on American literature, focusing particularly on Jack London, Charlotte Perkins Gilman and George Schuyler. What unites these books (and the diverse topics they address) is new ways of imagining the future, specifically a future based in biology.

Dreams of scientific utopias were, of course, nothing new. Ever since Francis Bacon's *New Atlantis* appeared (posthumously) in 1627, the idea that science (and the technologies it enabled) would be used to transform human life has reappeared, generation after generation. However, most of the resulting utopias were based on the physical sciences: humans would fly, generate new kinds of energy, and transform the elements into new materials. As a result, the ill effects of nature would be ameliorated, but nature itself – although managed effectively – would remain largely unchanged. The sciences of living things, botany and zoology, played little part in most of these fantasies. It was assumed that medicine would improve, allowing us to live longer (but be otherwise

1 J.B.S. Haldane, *Daedalus; Or, Science and the Future*, 1st edn (London: Kegan Paul, Trench, Trubner & Co., Ltd, 1924), pp. 9–10.

unchanged), and Bacon imagined the masters of his fictitious research community, Salomon's House, would be able, 'by grafting and inoculating', to make trees produce their fruit out of season and to improve its taste and colour. Bacon's natural philosophers also claimed 'by mixtures of earths without seeds' to be able to 'make divers new plants, differing from the vulgar, and to make one tree or plant turn into another'.[2] However, while the physical sciences advanced dramatically in the three hundred years after Bacon published, the life sciences made slower progress. Plants and animals could, indeed, be improved only by slow, careful, selective breeding. By the close of the nineteenth century the almost magical ability to make one organism 'turn into another' was reserved for evolution by the slow, plodding means of natural selection. Darwin's theory of slow, gradual change – modelled on the work of gardeners and breeders – was persuasive to many, but it was frustratingly slow to those still dreaming Bacon's dream.

Yet all that changed abruptly after 1900. In 1907, the *New-York Tribune* announced, 'The dream of Bacon, who saw in the New Atlantis gardens a land devoted to the modification of animals and plants at man's will, is being realized by the Carnegie Institution at its new "Station for Experimental Evolution" at Cold Spring Harbor, Long Island'.[3] This new, previously unimaginable, research field – experimental evolution – was partly the product of two new scientific theories. The famous one was, of course, Mendel's, rediscovered in 1900 and rapidly confirmed and extended by experimenters around the world; yet it was its all-but-forgotten contemporary, Hugo de Vries's mutation theory, that really inspired the new approach. As Curry shows, the ideas of de Vries – combined with the practical results of the Californian plant breeder Luther Burbank – created the expectations that Mendelism would eventually fulfil. De Vries was the guest of honour at the opening of Cold Spring Harbor, and its first director, Charles Davenport, used the occasion to hail de Vries's *Die Mutationstheorie* (1901–1903) as 'the most important work on evolution since Darwin's "Origin of Species," a work destined to be the foundation stone of the rising science of experimental evolution'.[4]

De Vries's theory was based on experimental evidence derived from a species of evening primrose, *Oenothera lamarckiana*. After twenty years of work, de Vries claimed to have proved that this plant was undergoing what he called a 'mutation period', and was generating a range of new species almost overnight. As he wrote, 'once formed, the new species are as a rule at once constant. No series of generations, no selection, no struggle for existence are needed'.[5] It was the rapidity with which

2 Francis Bacon, *New Atlantis and the Great Instauration*, ed. Jerry Weinberger (Wheeling, IL: Harlan Davidson, 1989), p. 74.

3 John Elfreth Watkins, 'Creation of species: work done at Station of Experimental Evolution', *New-York Tribune*, 24 February 1907, p. 2 (Library of Congress, Chronicling America, available at http://chroniclingamerica.loc.gov/lccn/sn83030214/1907-02-24/ed-1/seq-18).

4 Charles Benedict Davenport *et al.*, 'Addresses at opening of the Station for Experimental Evolution, June 11, 1904', *Carnegie Institution of Washington Year Book* (1905) 3, p. 39. For a fuller account of the early reception of the mutation theory see Garland E. Allen, 'Hugo De Vries and the reception of the "mutation theory"', *Journal of the History of Biology* (1969) 2(1), pp. 55–87; Jim Endersby, *A Guinea Pig's History of Biology: The Plants and Animals Who Taught Us the Facts of Life*, London: William Heinemann, 2007.

5 Hugo de Vries, 'The origin of species by mutation', *Science* (1902) 15(384), pp. 723–724.

Oenothera appeared to be mutating that created the promise of experimental evolution; evolution was now, apparently, fast enough to be observed in a laboratory, which suggested the further possibility that, once the causes of mutation were understood, new mutations might be produced to order. The US journalist E.T. Brewster (in an article Curry cites) told readers of the popular monthly *World's Work* that recent studies had suggested how 'Nature can be prodded out of her too leisurely ways and made to provide these "mutations" in greater quantity than she has been doing'. He went on to explain how Daniel T. MacDougal, 'a disciple of de Vries', had been able to 'shake up the protoplasm' of his evening primroses by injecting 'the seed capsules with various chemicals – zinc sulphate, calcium nitrate, sugar solutions, radium preparations'. Most were unaffected, but a few, 'here and there, developed new unit-characters and became new species of primroses'.[6] This work has been explored in Luis Campos's excellent book *Radium and the Secret of Life* (which Curry cites).[7] Campos's insightful exploration of the enticing links between the new science of radiation and its effects on living things forms a natural companion to Curry's superb book; each tells a different aspect of a story that began (in part, at least) with de Vries, but they follow different strands of the later attempts to realize 'the dream of Bacon' and fulfil the promise of experimental evolution.

Curry's tale looks at successive attempts to control plant evolution by inducing mutations. As she notes, within the scientific community interest in de Vries's original theory faded almost as rapidly as it had begun, once it became clear that *Oenothera lamarckiana* was behaving in a very unusual way and, as a result, could not be used as a model from which general rules could be derived. The scientists whose work she studies turned to other plants and a variety of new techniques to try and induce new variations in them. For example, James Mavor (working at the General Electric Company in the early 1920s) and Lewis Stadler (a little later at the University of Missouri) both subjected plants to X-rays to generate changes. (Among its many other important achievements, her book thus provides a useful corrective to the still-common view that Hermann J. Muller invented X-ray mutations single-handedly when he started zapping *Drosophila* with them.) However, Muller was the first to publish, which prompted the plant experimenters to publish their results and Curry argues persuasively that the intense media interest generated by these announcements is another reason why the earlier, directly de Vriesian, work has been largely forgotten (p. 38).

Following the X-ray breakthrough, other technologies were deployed, such as the chemical colchicine, which could induce chromosome duplication (polyploidy) in many plant species. (Such duplications were one source of the strange new varieties of *Oenothera* that had originally caught de Vries's attention, but – as so often in the *Oenothera* story – it was a more cooperative rival plant, a primrose called *Primula kewensis*, that provided the detailed experimental evidence which allowed polyploidy to be unravelled.) Later chapters explore the creation of 'gamma fields', experimental

6 E.T. Brewster, 'Breeding plants and animals to order', *World's Work* (1907) 15(2), pp. 9653–9658, 9657.

7 Luis Campos, *Radium and the Secret of Life*, Chicago: The University of Chicago Press, 2015, reviewed in *BJHS* (2017) 50(3), pp. 537–543.

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gardens surrounding a central source of intense radiation, which were an unexpected (and largely unstudied) aspect of the post-Second World War drive towards 'atoms for peace'. Brookhaven National Laboratory was one of several to found a biology department whose experimental gardens were arranged in a circle around a cobalt-60 radiation source that could be lowered into a lead pipe to allow researchers to examine the plants. The circular planting meant that the plants received more radiation the closer they were to the central source. Perhaps the most surprising outcome of the experiments that began in these fields was an advert she reproduces (p. 178) for 'Dr. Speas Atomic-Energized Seeds and Plants', headed 'It's AMAZING! It's at WALGREENS'. As with the earlier colchicine craze, ordinary gardeners could pop down to their local drugstore and buy a packet of irradiated seeds in the hopes of finding their gardens full of giant tomatoes or unfeasibly large carrots. Curry could perhaps have made her wonderful book even better by tracing the public's fascination with these new plants a little further afield; one of the colchicine reports (p. 103), for example, actually mentions H.G. Wells's novel *The Food of the Gods* (in which a new, scientific food creates first giant vegetables and then giant people). The impact of these new sciences on early science fiction would have added another, rich dimension to the story Curry tells, but the book is already testimony to a massive amount of research, and – like all really good books – rich with intriguing possibilities for others to follow up.

Among the most fascinating aspects of Curry's work is the way it reveals that although the underpinning technologies and scientific theories behind 'made-to-order' plants changed several times, the language in which these advances were described remained remarkably consistent. For example, she notes that, around the year 1900, Burbank's plant-breeding work (which relied on entirely conventional techniques, albeit on a large scale and presented with considerable, vaguely mystical, hyperbole) played a key role in creating the expectation that something the public vaguely understood to be 'scientific' plant breeding was about to transform America's farms and the food they produced. Almost thirty years later, when the X-ray results were being announced, a *New York Times* writer hailed them as 'a new method for Burbanking flowers and plants for man's benefit' (p. 42). Part of Burbank's appeal was the idea that gardeners and farmers could learn his techniques and apply them to their own flowers and, as Curry shows, new technologies such as colchicine were marketed directly to amateur gardeners. Among the chemical's most avid promotors was the Burpee Seed company, which had bought the rights to many of Luther Burbank's 'creations' after his death. Encouraging gardeners to 'Burbank' their flowers with the new chemical was an aspect of the short-lived colchicine craze that created considerable continuity between Burpee's professional breeders and the backyard tinkerers (pp. 131–140). And, as she notes, the language of controlling evolution and creating new plants to order has, of course, persisted – even though the specific technologies she explores were largely unsuccessful.

In the early twentieth century, the science of making new plants was always connected to the hope of creating new animals, including people. The same *New-York Tribune* article that described the 'dream of Bacon' coming true also quoted Davenport as saying, 'when we know the law [of mutation] we may control the process, the principles of evolution will show the way to an improvement of the human race'.[8] Davenport was, of course, a keen proponent of eugenics (as was almost every other geneticist of the time, particularly in the USA). And the claim that biology could create a better future was as much the underpinning of eugenics as it was of plant breeding. (Indeed, one of Burbank's most popular works was *The Training of the Human Plant* (1906), in which he set out his own, typically idiosyncratic, recipe for making better people.) And just as dreams of mutant plants, animals and perhaps supermen became staples of early science fiction, the dream of eugenics exercised a powerful hold on more literary writers, as Ewa Luczak shows.

The influence of eugenics on twentieth-century American writers is, of course, hardly a new topic, and Luczak has chosen three writers (London, Gilman and Schuyler) whose relation to eugenics has already been fairly well studied. Luczak offers some nuanced and carefully qualified amendments to the existing scholarship on these writers, and the degree to which *BJHS* readers will find her literary analyses of interest will probably depend on how familiar they are with the existing literature. However, when it comes to historical matters, Luczak is a little less sure-footed: the American sociologist Lester Frank Ward becomes 'Lester D. Ward' (p. 103); Hannah Arendt's first name is transformed into the disconcertingly Buchanesque 'Hannay' (p. 35) and there are numerous similar slips. While some of these may simply be typos (and thus, perhaps, the responsibility of her publisher), the claim that Francis Galton was Charles Darwin's nephew (p. 2), rather than his cousin, suggests a more serious lack of historical background. And the claim that 'Darwin developed a taxonomy in the animal world, [and] eugenicists, following evolutionary anthropologists, concluded that it is possible and even desirable to develop a similar taxonomy for humans' (p. 20) entails so many mistakes that it would require a whole essay to fully correct it.

Perhaps as a result of an insufficient grasp on the history of science Luczak tends to collapse every kind of biological argument into one unified thing called 'eugenics'. For example, she refers to the Cold Spring Harbor Station for Experimental Evolution as a 'eugenic station' (p. 101), when in fact the Eugenics Record Office was not established there until several years after the original station (experimental evolution came first, in more than one sense). This lack of careful analysis may be why she characterizes eugenics as 'a major trope, structuring principle and even ideological core' (p. 1), which is rather too vague to be helpful. Had she chosen to define eugenics more precisely (and historically), she might have paid more attention to the fact that eugenics was never a single, unified 'discourse', but was a set of ideas that straddled different models of heredity and different political affiliations and which thus resulted in a diverse range of supposedly eugenic strategies. Her mistaken assertion that eugenicists were opposed to Lamarckian evolution (p. 17), for example, makes it particularly difficult for her to grasp why and how so many progressive people embraced eugenics. Diane Paul's work on this topic is conspicuously absent from Luczak's bibliography, and if Luczak had read it she would have found the apparent contradictions between London's

8 Watkins, op. cit. (3).

socialism and Gilman's feminism and their respective eugenic commitments rather less surprising. These criticisms are not merely historical nit-picking, because they seem to hamper Luczak's literary analyses. For example, her assumption that Gilman's feminism and eugenics were self-evidently contradictory leads her to describe Gilman (somewhat implausibly) as a 'well-meaning' (p. 120) woman but one who supposedly 'lost sight of' (p. 101) her own contradictions because of her excessive respect for scientific expertise.

Luczak's book, like much historical and literary work on the topic, finds the values of the eugenicists deeply – and understandably – repellent, but I found myself wondering whether this reaction is a further hindrance to a real historical understanding. Rather than rehearsing the crimes of eugenics (which are so self-evidently monstrous and well known that they hardly need belabouring), it might have been more useful to analyse the widespread popular enthusiasm for eugenics as another aspect of the wider interest in experimental evolution that scholars like Curry and Campos are revealing. The early decades of the twentieth century were characterized in part by a widely held belief that biology was, for the first time, capable of engineering new and better futures. Seen in that context, the enthusiasm that so many (including socialists and feminists) felt for eugenics no longer appears as a well-meaning but self-deluding ability to hold contradictory beliefs. Instead, the women who flocked to public meetings on eugenics (and women were especially prominent in many Anglo-American eugenic groups) begin to seem like close cousins of Curry's experimental gardeners, applying colchicine to their marigolds; these two apparently unconnected groups each wanted to experiment with evolution for themselves – they shared the hope of giving birth to a future race. I make this link not to encourage sympathy for eugenics, but because if one of the reasons we study history is in order to avoid repeating its mistakes, we need to fully understand how those mistakes were made; the understandable desire to condemn eugenics and all that flowed from it may prevent us from understanding how so many otherwise decent people ever came to see these appalling ideas as good ones. For me, Curry's book unexpectedly opened up rich possibilities for understanding this question and will surely prompt further scholarship on this, still largely unexplored, aspect of how early twentieth-century biology shaped the ways in which non-scientists tried to imagine the future.

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