Evolution Made to Order: Plant Breeding and Technological Innovation in Twentieth-Century America

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H. A. Curry. Evolution Made to Order: Plant Breeding and Technological Innovation in Twentieth-Century America. Chicago, IL and London: University of Chicago Press, 2016, vii + 285 pp. 28 plts. $42.75. ISBN 13:978-0-226-39008-6.

In this excellent and timely first book, Helen Anne Curry explores the efforts of both amateur and professional plant breeders to accelerate the appearance of variations in plants by using new technologies. In the history of biology and genetics, this topic has received scant attention despite its obvious importance to our understanding of inheritance and evolution. Drawing on a rich set of untapped primary source materials, she also brings together scholars in history of technology and history of biology, most of whom have never been considered in tandem. With her intellectual curiosity and analytical agility, Curry tells a story that is surprising, provocative, and generative.

During the first few decades of the 20th century, breeders looked for plant characteristics in their open fields, searching for that novel and promising that might be bred into future generations through traditional cross-fertilization techniques. It was a needle-in-the-haystack approach, time-consuming and often fruitless, but it was thought to be the only way to create plants with new features. As biologists studied Mendel's work, however, they began to realize that it might be possible to actually create what were now called "mutations" through technological and chemical means. In the course of the book Curry analyzes the people, institutions, technologies, and logics through which induced mutation techniques were developed.

Curry divides her story into three parts. The first considers the use of x-rays to create useful mutations, a technique first suggested by Willis Whitney, heard of the research laboratory at General Electric, which held the patent for the high-vacuum x-ray tube. Whitney was motivated not only by the possibility of finding new uses – and sales – of x-ray machines, but also understanding how x-rays would affect biological organisms. A number of labs around the country began experimenting with x-rays, hoping to induce variations that could solve all kinds of agricultural problems and horticultural opportunities. Research scientists such as Herman Muller and Lewis Stadler, on the other hand, could easily disagree about whether x-rays would change the world of inheritance, or remain as an entertaining novelty.

In Part II, Curry turns to chemical means of inducing variation, in particular using the plant alkaloid colchicine, which doubled the numbers of a plant's chromosomes and often created significant plant growth. Horticulturalists were particularly interested in colchicine. They were in the business of novelty, after all, selling plants to home gardeners who were very keen to acquire the latest ornamentals. Experimentation followed three tracks. In the first, geneticists tried to used cochicine to induce what one called "genetics engineering," that is, carefully altering chromosome numbers to generate new variations and, perhaps, new organisms. The second track involved commercial plant breeders such as David Burpee, who imagined creating loads of new ornamentals by using colchicine. The third track did not focus upon research per se, but involved the use of colchicine by home gardeners who were simply interested in this peculiar new technique of plant improvement and were able to easily buy and use colchicine. This part of the story is especially interesting because it demonstrates several important things. For one thing, the faddish nature and huge popularity of colchicine, including the co-option of gardeners by some of the more serious breeders, did seem to move the scientific research down the road. The amateur tradition in this case, as elsewhere, contributed much more to the resulting science than scientists are wont to recall. For another thing, scientists themselves could not agree on the usefulness of colchicine, yet its potential to revolutionize cytogenetic research was hard to ignore. There may be more to say about this professional dispute; it does offer a close and telling look at how scientific knowledge gets developed.

In Part III, Curry turns to the post-WW II enthusiasm with all things atomic, including the importance of radiation for inducing mutations in plants. Here she grounds her discussion in the larger framework of constant nuclear research and military readiness that followed the war, and the military's commitment to popularizing and promoting the use – "consumption" – of atomic power in as many spheres as possible. Brookhaven National Laboratory was created for just this purpose, and although most of it was devoted to physics, medicine, and engineering, a substantial effort was directed toward inducing mutations using a gamma field facility. This technology was adopted by many other universities and laboratories around the world; one of the most prolific was the University of Tennessee-- Atomic Energy Commission Agricultural Research Laboratory. Curry argues quite convincingly that we cannot really understand this genetics research without understanding the elaborate military technological system in which it was embedded. Indeed, the technological system itself drove the research, rather than the other way round, as is common with systems that develop their own momentum. Scientists had very little to show for all this atomic research into plant inheritance when it was all said and done, but the federal atomic organization could point with pride to their commitment to “atoms for peace” and their support for basic research.

Curry ends her book with a reflection on the similarities and differences between these technological approaches to inheritance and more contemporary controversies regarding “genetically modified organisms, a welcome historical reminder. Overall, the historical lessons go beyond this. One is how quickly and easily gardeners adopted “atomic seeds” and colchicine to get bigger plants, utterly unconcerned with the potential health issues involved. Perhaps it was a more innocent age, but perhaps people are still more interested in novelty and experimentation than they are worried about the long-term consequences. Another take-home is that experimentation, whether technological or scientific, tends to occur within quite large-scale systems that may not be entirely visible to the casual observer. This is important because it is easy to lose sight of the positive momentum – improved medical treatments, e.g., -- as well as the negative momentum – unsafe treatments, or no progress at all. As Curry shows so well, experimentation is often neither linear nor productive, and is sometimes driven more by fantasy than sure results. Curry’s clear and appealing writing, and her layered analysis, make this a wonderful and important book.

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