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Historians study the causes and consequences of past events, but also consider alternative scenarios. What might have happened, for example, if Britain had stayed out of the European war in 1914? Science historians also ask what-might-have-happened or “counterfactual” questions, and the results can be surprisingly instructive.

Take genetics. The last twelve months have seen prolonged celebrations of the work of Gregor Mendel, timed to the 150th anniversary of the paper reporting his experiments with hybrid peas. Mendel's experiments are central to biology curricula across the world. By contrast, the criticisms levelled at those experiments by W. F. R. Weldon, Linacre Professor at Oxford, are at most a footnote.

From 1902, Weldon’s views brought him into increasingly bad-tempered conflict with Mendel’s followers. In basic terms, the Mendelians believed that inherited factors (later called “genes”) determine the visible characters of organisms, while Weldon saw context -- developmental and environmental -- as just as important, its influence making characters variable in ways that Mendelians ignored. The Mendelians won - helped by Weldon's sudden death in 1906, before he published his ideas fully - and the teaching of genetics has emphasised the primacy of the gene ever since.

The problem is that some researchers increasingly view the Mendelian “genes for” approach as out of step with twenty-first century biology. If we are to realise the potential of the genomic age, they say, we must find new concepts and new language better matched to variable biological reality. This applies not least in education, where the reliance on simple examples may even promote an outmoded determinism about the power of genes.

But what if Mendelism had never come to dominate genetics in the first place? What if Weldon's perspective had emerged as the winner in that historical battle and his interactionism, allied to his vivid sense of how variable the real characters of real organisms are (never just yellow or green, round or wrinkled, or any other Mendelian binary), had become the core of the subject? This is where I, and colleagues, have tried not just to speculate but to go back and meddle experimentally.

Over a recent two-year project, we taught university students a curriculum altered to reflect what genetics textbooks might be like now if biology circa 1906 had gone Weldonian rather than Mendelian. These students encountered genetics from the first lecture as fundamentally tied to development and environment. Genes were not presented to them as what inheritance is "really about" with everything else relegated to ignorable supporting roles. On the heart, for example, they were taught that while genes can affect cardiovascular condition directly, they also affect blood pressure, activity levels and other influential factors, themselves often influenced by other, non-genetic factors (such as smoking). Where in this tangle, we ask them, is a gene for heart disease?

In effect, this revised curriculum seeks to take what is peripheral in the existing teaching of genetics and make it central, and to take what is central and make it peripheral.

Our experimental group, those students who were taught the altered curriculum, were second-year humanities (mainly philosophy) undergraduates. First-year biologists, taught the conventional approach, acted as our control. We saw a difference - those students taught the Weldon way emerged as less believing of genetic determinism, and, I suspect, better prepared to understand the subtleties of modern genetics. (The difference was statistically significant, but I hesitate to make much of that given that numbers were small and there were differences in the conditions of the groups. I am mindful, too, that it was Weldon who first drew attention to Mendel's own problems with exaggerated statistics.)

With experiments along these lines, bringing insights from the archive into the science classroom, the scientific past can inform and maybe even improve the scientific future. Such experiments in turn suggest a broader vision of collaboration. To advance scientific knowledge, historians and philosophers of science should work in close proximity to scientists, not actually in the lab but right down the corridor. There, their investigations into neglected phenomena, debates shut down too soon and so on, might serve the cause of creative science by providing just the right measure of provocation.

What of Mendel? Some might complain that it is a poor anniversary gift to jettison him from his place of honour in the genetics curriculum. Let me suggest that grumbling along these lines, though understandable, is misguided. If we want to honour Mendel then let us read him seriously, which is to say historically, without back-projecting the doctrinaire Mendelism that came later. Study Mendel, but let him be part of his time.

Likewise, let our biology students be part of their time, by giving them a genetics curriculum that is fit for the twenty-first century. If we teach them about Mendel, we should do so not to fill them with slack-jawed wonder at his foundational achievement, but to help them appreciate how even the most imaginative and rigorous science - and Mendel's was first rate on both counts - shows the stamp of the historical circumstances of its making. To learn that lesson well about past science is to bring a welcome level of self-awareness and critical self-reflection back to the present.

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