

## ‘History Will Be Kind to Me’: An Introduction to New Directions in the Historiography of Genetics

‘History will be kind to me, for I intend to write it’, Winston Churchill is famously said to have quipped. That he never seems to have actually said that is beside the point, since the message is important: Past events never speak for themselves. Facts do not settle like rocks in a dry river, but are placed and replaced by waters that continue to gush. Such waters are signs of their times, sensitive to mores and temperatures. And the keepers of the waters, more often than not, are historians.

Recently, an attempt has been made to fill a lacuna in the form of rather meagre sources for the historiography of biology (Dietrich, Borrello, Harman, 2021). It’s important that historians of biology be aware of what fellow practitioners had to say before them, and it is a fantasy to believe, as some who do not value intellectual stock do, that something can come of nothing (Newstok, 2020). At the same time, it is crucial to allow the rivers to continue to roar: new interpretations, even the uncovering of new facts, are what keep history alive.

This special issue is devoted to new directions in the historiography of genetics, a field that has seen particularly lively drift and swirl and surge in recent decades. Radical re-assessments of the history of genetics have been offered for most of the major turning points in the field, and many of its salient features, going back to its inception. Gregor Mendel’s *Versuche über Pflanzen-Hybriden*, for example, is no longer simply regarded as a study of the problem of heredity but has been placed more deliberately in the Moravian agricultural content from which it spawned (e.g. Olby 1979; Gliboff 1999; Müller-Wille and Orel 2007; Shan 2021). The so-called ‘rediscovery’ story has been greatly reshaped to the point of suggesting a renaming (e.g. Meijer 1985; Rheinberger 1995; Simunek, Hoßfeld, and Breidbach 2011). The Mendelian-Biometrician controversy has been re-examined and re-framed (e.g. Sloan 2000; Radick 2005; Pence 2011; Shan 2020). The gene-centric narrative of the history of genetics has been seriously challenged (e.g. Keller 2000; Oyama 2000; Waters 2006; Falk 2009), buttressed by histories of outliers to the evolutionary synthesis (Schloegel 1999; Dietrich 2003; Harman 2004; Richmond 2007), as well as an increasing interest in the historiographical role of the genome, which was a counterweight to the reductionist pursuit of the gene (Lamm 2014; 2015; Dietrich et al. 2021). The history of developmental biology has been retold (Kirschner and Gebhart 2005; Laubichler 2007; Crowe et al. 2015). The relationship between genetics, eugenics, and medicine has been re-examined (Comfort 2012). The role of the molecularization of biology has been highlighted (Morange 2020). The significance and role of women in the history of genetics is being reassessed (e.g. Dietrich and Tambasco 2007; Richmond 2007; 2017; Markel 2021). And the role of non-Western geneticists and the networks they created is being established (e.g. Dietrich 2016). Adding to the plethora of new scholarship in the field, this special issue specifically explores new approaches in the historiography of genetics, with the hope of providing novel reflections and perspectives.

In ‘Mendel the fraud? A social history of truth in genetics’, Greg Radick re-examines a great myth about Mendel’s work. Widely acknowledged as the father of genetics, Mendel has been accused of faking his data: Going back to R.A. Fisher, the statistics Mendel reported from his experiments on *Pisum* just seemed too good. Radick suggests that the history of interest in Mendel’s data itself has an intriguing structure. He shows that although the data problem was

first noted by W. F. R. Weldon in 1901 and rediscovered by R. A. Fisher in 1911, there was no public outcry over Mendel's data nor truthfulness in the following decades. Radick argues that the data problem became widely discussed and agonized over beginning in the 1960s for reasons having as much to do with Cold War geopolitics as with traditional concerns about the objectivity of science. He contends that appreciating the Cold War origins of the problem can be a helpful step in shifting the discussion in more productive directions, scientific as well as historiographic.

Adam Krashniak and Ehud Lamm revisit the work of another pioneer of the study of heredity, Francis Galton. In 'Francis Galton's regression towards mediocrity and the stability of types', they argue against the received view that after 1885, Galton came to explain the fact that offspring deviated less from the mean value of the population than their parents did as a population-level statistical phenomenon and not as the result of the processes of inheritance. Krashniak and Lamm show that Galton did not explain regression towards mediocrity statistically, and did not give up on his ideas regarding an inheritance process that caused offspring to revert to the mean; these ideas were tied to his notion of the stability of the organism. They further argue that Galton's concept of regression towards mediocrity is significantly different from the modern statistical concept of regression to the mean. Galton is therefore best viewed as a transitional figure in the understanding of the statistical phenomenon of regression to the mean. Accordingly, the authors argue for closer attention by historians of genetics to Galton's other intellectual pursuits and their specific contexts, in particular, anthropology and anthropometry.

Charles Pence re-examines the so-called Mendelian-Biometrician controversy at the beginning of the twentieth century by carefully revisiting the work of the Biometricians, and especially Weldon. In 'Of Stirps and Chromosomes: Generality Through Detail', he argues against the assumption that one of the biometricians' great flaws was their inability to look past their population-focused, statistical, gradualist understanding of evolutionary change. To the contrary, developments in cellular biology around 1900 were very much central to their claims. Pence shows that the work of the biometricians was, from its earliest days, fundamentally concerned with connections between statistical patterns of inheritance and the underlying cellular features that gave rise to them. He elaborates on how they conceived that such a connection can be established, helping to outline their philosophy of science.

Yafeng Shan challenges the traditional historiography of the Mendelian-Biometrician controversy in a more radical way. In 'Beyond Mendelism and Biometry', he argues that the Mendelian-Biometrician distinction is no longer a useful conceptual tool for the historiography of genetics, and should be abandoned. Shan argues that the Mendelian-Biometrician distinction fails to reflect the diversity of the contenders' views on heredity in the debate, as well as their nuanced dynamics, holding that it impedes a better understanding of genetics in the first decade of the twentieth century. He concludes that we will have a fuller understanding of the development of genetics and the biological sciences in the 1900s if we go beyond the Mendelian-Biometrician framework.

In 'Kristine Bonnevie's theories on the genetics of fingerprints, and their application in Germany', Amir Teicher provides a historical reconstruction of the efforts to geneticize fingerprints as a Mendelian phenomenon, focusing on the theories put forward by the Norwegian biologist Bonnevie. Teicher argues against a typical historiographical narrative,

which portrays Bonnevie methods as lacking genuine scientific validity and reliability and views their temporal adoption as yet another case of zealous Nazi scientists rushing to implement over-simplistic genetic models to advance their eugenic and racial goals. He argues that German and Austrian scientists were eager to use any available biological knowledge to assess (among other things) questions of paternity, but this does not imply they were simple-minded or methodologically lax. Teicher indicates that the developments in Bonnevie's work may be seen as a reflection of tensions that far surpass her own agency and are inherent to the challenge she took upon herself. These tensions lay between the complexity of the studied object and the reductionist framework of Mendelian genetics, between the uncertainty inherent to data on human families and the wish to extract from them fixed patterns, and, more generally, between the sterility of scientific theories and the coarseness and ambivalence of real-life phenomena. Teicher maintains that the history of genetics should be the history of navigating these tensions.

Following Joan Scott's suggestion that gender is a legitimate and necessary category of historical analysis, Marsha Richmond revisits the role of women in the history of genetics. In 'The imperative for inclusion: A gender analysis of genetics', she focuses on women's place in three important experimental research institutions of classical genetics in the UK, US, and Germany, and in the leading university-based research program of T. H. Morgan at Columbia. Richmond argues that gender analysis provides a promising approach to the comparative and systematic study of the development of genetics, and in turn offers the prospect of providing a richer historiography of genetics. The imperative for inclusion – of both women and gender analysis – she concludes, will not only result in a more equitable and informative picture of the discipline's development, but also yield a historiography that more faithfully reflects the activity of doing science.

The papers in this Special Issue, together with others, attest to the exciting new challenges in the historiography of genetics. Far from being a tired, well-established story of progressive discovery, new work problematizes and adds texture to fundamental aspects of the history of genetics. These include the social practice of science (Richmond, this issue); the periodization of the history of genetics (Shan, this issue); the relations between theory and evidence (Pence, this issue; Krashniak and Lamm, this issue); reception studies and the biases of history that accompanied the success of the molecular genetic paradigm (e.g., Veigl et al. 2020); as well as situating the writing of the history of genetics within broader cultural history (Radick, this issue).

Most of the papers in this special issue emerged from the 32th Annual International Workshop on the History and Philosophy of Science: 'New Directions in the Historiography of Genetics', which took place in November 2019 at the Cohn Institute of History and Philosophy of Science and Ideas, Tel Aviv University, Israel. The workshop was generously funded by the Van Leer Jerusalem Institute. We would like to thank the authors who have contributed to this special issue, as well as our colleagues at the IHPLS program, the Cohn Institute, and the Van Leer Institute. The work of writing the history of genetics continues. And while it would seem that Churchill did not promise to ensure his posterity by writing his own history, though he tried to so in practice, he did say these sage words: 'Success is not final, failure is not fatal, it is the courage to continue that counts.'

## References

- Comfort, Nathaniel. 2012. *The Science of Human Perfection: How Genes Became the Heart of American Medicine*. New Haven, CT: Yale University Press.
- Crowe, Nathan, Michael R. Dietrich, Beverly S. Alomepe, Amelia F. Antrim, Bay Lauris ByrneSim, and Yi He. 2015. "The Diversification of Developmental Biology." *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 53: 1–15.
- Dietrich, Michael R. 2003. "Richard Goldschmidt: Hopeful Monsters and Other 'Heresies'" *Nature Reviews Genetics* 4: 68-74.
- Dietrich, Michael R. 2016. "Experimenting with Sex: Four Approaches to the Genetics of Sex Reversal before 1950." *History and Philosophy of the Life Sciences* 38: 23–41.
- Dietrich, Michael R., Mark E. Borrello, and Oren Harman, eds. 2021. *Handbook of the Historiography of Biology*. Cham: Springer.
- Dietrich, Michael R., and Brandi H. Tambasco. 2007. "Beyond the Boss and the Boys: Women and the Division of Labor in Drosophila Genetics in the United States, 1934-1970." *Journal of the History of Biology* 40 (3): 509–28.
- Falk, Raphael. 2009. *Genetic Analysis: A History of Genetic Thinking*. Cambridge: Cambridge University Press.
- Gliboff, Sander. 1999. "Gregor Mendel and the Laws of Evolution." *History of Science* 37: 217–35.
- Harman, Oren Solomon. 2004. *The Man Who Invented the Chromosome: A Life of Cyril Darlington*. Cambridge Mass.: Harvard University Press.
- Keller, Evelyn Fox. 2000. *The Century of the Gene*. Cambridge, MA: Harvard University Press.
- Kirschner, Mark and John Gebhart. 2005. *The Plausibility of Life: Resolving Darwin's Dilemma*. New Haven, CT: Yale University Press.
- Lamm, Ehud. 2014. "The Genome as a Developmental Organ." *Journal of Physiology* 592 (11): 2237–44.
- . 2015. "Systems Thinking versus Population Thinking: Genotype Integration and Chromosomal Organisation." *Journal of the History of Biology* 48 (4): 641–77.
- Maienschein, Jane and Manfred Laubichler, eds. 2007. *From Embryology to Evo-Devo: A History of Developmental Evolution*. Cambridge, MA: MIT Press.
- Markel, Howard. 2021. *The Secret of Life: Rosalind Franklin, James Watson, Francis Crick, and the Discovery of DNA's Double Helix*. New York: W.W. Norton.
- Meijer, Onno G. 1985. "Hugo de Vries No Mendelian?" *Annals of Science* 42 (3): 189–232.
- Morange, Michel. 2020. *The Black Box of Biology: A History of the Molecular Revolution*. Cambridge, MA: Harvard University Press.
- Müller-Wille, Staffan, and Vitězslav Orel. 2007. "From Linnaean Species to Mendelian Factors: Elements of Hybridism, 1751-1870." *Annals of Science* 64 (2): 171–215.
- Newstok, Scott. 2020. *How To Think Like Shakespeare: Lesson from a Renaissance Education*. Princeton, NJ: Princeton University Press.
- Olby, Robert Cecil. 1979. "Mendel No Mendelian?" *History of Science* 17 (1): 53–72.

- Oyama, Susan. 2000. *Evolution's Eye*. Durham, NC: Duke University Press.
- Pence, Charles H. 2011. "The Statistical Philosophies of W. F. R. Weldon and Karl Pearson." *Studies in History and Philosophy of Biological and Biomedical Sciences* 42 (4): 475–85.
- Radick, Gregory. 2005. "Other Histories, Other Biologies." *Royal Institute of Philosophy Supplement* 80 (56): 3–47.
- Rheinberger, Hans-Jörg. 1995. "When Did Correns Read Gregor Mendel's Paper?" *Isis* 86 (4): 612–16.
- Richmond, Marsha L. 2007. "Opportunities for Women in Early Genetics." *Nature Reviews Genetics* 8 (11): 897–902.
- \_\_\_\_\_. 2007. "The Cell as the Basis for Heredity, Development, and Evolution: Richard Goldschmidt's Program of Physiological Genetics." In *From Embryology to Evo-Devo: A History of Evolutionary Development*, edited by Jane Maienschein and Manfred D. Laubichler, 169–211. Cambridge, MA: MIT Press, 2007.
- \_\_\_\_\_. 2017. "Women as Public Scientists in the Atomic Age: Rachel Carson, Charlotte Auerbach, and Genetics." *Historical Studies in the Natural Sciences* 47 (3): 349–88.
- Shan, Yafeng. 2020. *Doing Integrated History and Philosophy of Science: A Case Study of the Origin of Genetics*. 1st ed. Boston Studies in the Philosophy and History of Science. Cham: Springer.
- \_\_\_\_\_. 2021. "Mendel on Developmental Information." In *Information and the History of Philosophy*, edited by Chris Meyns. London: Routledge.
- Shloegel, Judy Johns. 1999. "From Anomaly to Unification: Tracy Sonneborn and Species Problem in Protozoa, 1954-1957". *Journal of the History of Biology* 32 (1): 93-132.
- Simunek, Michal, Uwe Hoßfeld, and Olaf Breidbach. 2011. "'Rediscovery Revised' - The Cooperation of Erich and Armin von Tschermak-Seysenegg in the Context of the 'Rediscovery' of Mendel's Law in 1899-1901." *Plant Biology* 13 (6): 835–41.
- Sloan, Philip R. 2000. "Mach's Phenomenalism and the British Reception of Mendelism." *Comptes Rendus de l'Académie Des Sciences - Series III - Sciences de La Vie* 323: 1069–79.
- Veigl, Sophie, Harman, Oren, and Lamm, Ehud. 2020. "Friedrich Miescher's Discovery in the Historiography of Genetics: From Contamination to Confusion, from Nuclein to DNA". *Journal of the History of Biology*, 53 (3): 451-84.
- Waters, C. Kenneth. 2006. "A Pluralist Interpretation of Gene-Centered Biology." In *Scientific Pluralism*, edited by Stephen H. Kellert, Helen E. Longino, and C. Kenneth Waters, 190–214. Minneapolis and London: University of Minnesota Press.