# Statistically unlikely

**Francis Galton: Pioneer of Heredity and Biometry**
by Michael Bulmer
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The life of the Victorian polymath Francis Galton — who explored South Africa, created weather charts, introduced fingerprinting, studied anthropology, devised statistical methods and is perhaps best known for fostering ideas of hereditary improvement of humans through eugenics — continues to exert fascination for historians and scientists. A recent biography by the geneticist Nicholas Wright Gillham (see *Nature* **415,** 19–20; 2002) is now joined by statistician Michael Bulmer's book, which provides a distillation of some of Galton's ideas of heredity and statistics, reinterpreted from current thinking.

Bulmer's writing is very present-minded — many of Galton's ideas are taken out of the Victorian context in which he lived and worked. Instead, Bulmer imagines how Galton would have dealt with such problems if he were alive today, even though Galton could not have outlined a theory of quantitative genetics, as the discipline did not exist in his lifetime; nor could he have had any discussions on 'phenotypic variance', as this is an expression introduced by R. A. Fisher in the 1920s.

Bulmer thus provides little understanding of how Galton and his contemporaries would have tackled problems of heredity or statistics. When he does consider some of Galton's Victorian ideas, he simply construes that they reveal more about the opinions of Galton's contemporaries "than about the real world" — as if to say that Galton's contemporaries were not living in the real world. The reader thus never learns how the philosophical ideologies underpinning Galton's thinking, or that of the Belgian statistician Adolphe Quetelet, influenced their ideas about the normal distribution. Bulmer can only conclude that "Galton was mistaken to adhere to Quetelet". Yet Quetelet attached so much significance to the normal curve because of his belief in determinism, whereas Galton's belief in essentialism — which was the dominant thinking of the taxonomists, typologists and morphologists until the end of the nineteenth century, and gave rise to the morphological concept of species — implied that species regressed to the mean value. Galton was, therefore, convinced that all biological data could only be normally distributed.

The problem with Bulmer's 'internalist' approach is that the reader never really knows what Galton tried to do, as Bulmer wants to tell us instead what Galton should have done. Given Galton's own limitations with mathematics — he only managed to get a third class in the mathematics tripos at Cambridge University and had a breakdown during this time — he would have found Bulmer's mathematics impossible to understand, as, indeed, will anyone who is not a professional statistician.

Like his cousin Charles Darwin, Galton worked as an independent scientist and never held a university post. Inspired by Darwin's ideas on biological variation, Galton began to devise a statistical method to measure it. His statistical work caught the attention of the zoologist W. F. R Weldon, who was looking for a way to find a working hypothesis for Darwin's variation. In 1891, Weldon took up the Jodrell chair of zoology at University College London, where Karl Pearson was professor of applied mathematics. In 1892, Pearson, who had just devised the standard deviation, struck up an intellectual partnership with Weldon, who needed help interpreting a bimodal distribution (at a time when it was thought that all data had to conform to the normal distribution). Weldon introduced Pearson to Galton in 1894, but it was Weldon who gave Pearson the impetus he needed to develop a new statistical methodology. Bulmer's discussions on Weldon are entirely devoid of that vital interaction he had with Pearson; Bulmer thus fails to show that the reason Weldon was the first scientist to provide empirical evidence of natural selection was precisely because Pearson was devising new statistical tools for him. Although Pearson grew fond of Galton, this relationship did not really develop until after Weldon's premature death in 1906.

Pearson has long been erroneously viewed as a disciple of Galton who followed in his footsteps and merely expanded what Galton started — a view that Bulmer endorses. Thus, Bulmer's interpretation of galtonian and especially pearsonian statistics is deeply problematic. It is wrong to assume that the impetus to Pearson's statistics came from reading Galton's *Natural Inheritance* (Macmillan, 1889), especially as Pearson's initial reaction to this book was actually quite cautious. Pearson did not incorporate Galton's statistical ideas on correlation and regression for another six years, when Galton wrote to him asking for his assistance in 1895. By then, Pearson had already created the infrastructure of his statistical methodology. It was not until 1934, when Pearson was 78 years old, that he reinterpreted in a more favourable light the impact that Galton's book had on his own statistical work.

There is a long discussion of Galton's idea of correlation and statistical regression, but Bulmer never explains that Galton actually confused correlation with statistical regression. The reason the correlation coefficient is referred to by the letter *r* and not, say, *c* is that Pearson showed that Galton's correlation formula was a measure of regression instead, as it measured the slope of the regression line, and he retained Galton's *r* to symbolize the correlation coefficient.

This book is not so much a story about Galton as it is about Bulmer recalculating Galton's data using twentieth-century statistical methods. Perhaps Bulmer should have simply taken all of Galton's data and reanalysed it using contemporary statistical methods to gain a different understanding of Galton's data. ■

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**Website**

## Bringing Galileo to life

The revamped website of the Institute and Museum of the History of Science (IMSS), housed in one of the oldest palaces in Florence, the Palazzo Castellani, will be as valuable in its own way as the museum's collection.

The physical collections are heir to five centuries of acquisitions by the powerful florentine Medici and Lorraine families. They include innumerable scientific instruments and anatomical models — as well as Galileo's finger, which is famously displayed alongside many of the instruments he used (for a fuller description see *Nature* **425,** 128; 2003). They are among the most important collections in the world.

The new website animates the individual instruments, as well as describing and cataloguing them. For example, it describes how Galileo's compass came to be developed (see picture), and shows, through clever simulations, how it actually works.

IMSS

The website, launched on 24 March, is a work in progress, which will bring more life to more instruments — and to the museum itself — in the coming years. **Alison Abbott**

**www.imss.fi.it**