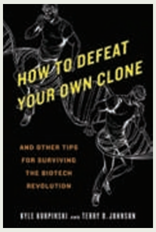
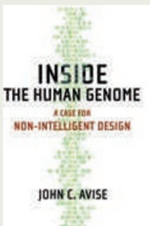
BOOKS IN BRIEF

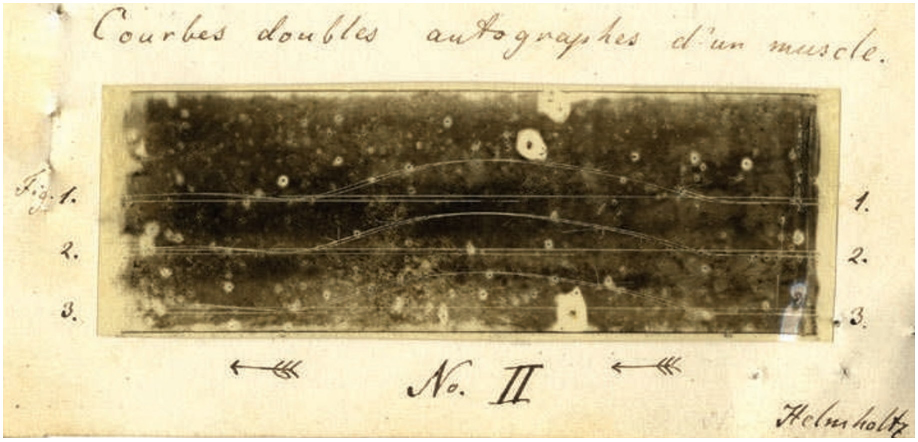


When the biotech revolution comes, we may turn to guidebooks to advise us on which genes we should delete to enhance our intelligence, how we might regenerate a limb or how we should interact with our clone. In their quirky guide to the future of biotechnology, *How To Defeat Your Own Clone* (Random House, 2010), bioengineers Kyle Kurpinski and Terry Johnson convey with simplicity and humour the science behind stem cells, genetic variation and bioenhancements. Their first rule: don't let your clone read this book.



Genetic reproduction brings with it the risk of flaws. In *Inside the Human Genome* (Oxford Univ. Press, 2010), evolutionary geneticist John Avise celebrates our inherent imperfections, from genetic mutations to downright design faults. Taking a philosophical look across human genomics and biochemistry, he unravels the perfectionist arguments of creationists and offers a nuanced view of what it is to be human.

In his neatly packaged paean to science, physicist Sander Bais calls on researchers to be vocal in defending the scientific method in an age of voluble but often unsupported public opinion. *In Praise of Science* (MIT Press, 2010) calmly sets out Bais's reasoning on why scientists should be proud of their rationality and desire to experiment. He reflects on how science has influenced social change across history, and how scientific research is a long-term endeavour that goes beyond short-term political attention spans.



ACADÉMIE DES SCIENCES/INSTITUT DE FRANCE

Hermann von Helmholtz's rediscovered curves show how frog muscle contracts and relaxes after nerve stimulation (time runs right to left).

Schmidgen found them hidden in the archives of the Paris Academy of Sciences in France. His discovery prompted him to tell the story of Helmholtz's ingenious experiments to both measure and demonstrate the speed of nerve conductance. Schmidgen's account, *Die Helmholtz Kurven*, shows how recognition was as important for scientists then as it is today.

In his earliest 'frog drawing machine', Helmholtz suspended the frog muscle and attached a weight to it by a thread. He attached a stylus to the thread and placed a rotating glass disk coated in soot directly in front of it. When he stimulated the nerve, the muscle contracted, pulling the stylus across the disk. The scratched curve showed the asymmetric form of the muscle contraction, with its slow build up and fade. However, he was reluctant to use the system to study the speed of nerve conduction, worried that friction would distort the results.

"Recognition was as important for scientists then as it is today."

Instead, he designed an almost friction-free system, adapting an electromagnetic approach used in ballistics to measure short time intervals. He used a galvanometer — a type of ammeter that detects and measures electric current — to transform the duration of muscle contractions into the deflection of a needle through electromagnetic force. To increase resolution, he measured the extent of the deflection through a telescope placed a few metres away.

He wrote up his results and rushed the paper to the Paris Academy of Sciences in February 1850, after it had been translated into French by his friend and colleague, the physiologist Emil du Bois-Reymond. The paper comprised three pages of abstraction and spectacularly failed to convince his contemporaries. A 90-page elaboration, full of numbers and written in German, also failed to hit the public nerve, as it were.

Helmholtz wondered whether perhaps his nerve–muscle preparation should do the communicating directly, and so returned to his frog drawing machine. He replaced the glass disk with a scaled-down drum made from a champagne glass with a smoked surface, and spun it fast enough for the stylus to scratch the shape and time course of a full muscle contraction into the soot. He compared the curves that were produced when the nerve was stimulated either close to, or distant from, the muscle. From the curve's displacement, he calculated the speed of signal propagation in the nerve — and got the same value he had calculated using his electromagnetic method.

He made ingenious permanent records of the scratched images, capturing them using a material called isinglass — a sticky collagen film made from the dried swim bladders of fish. Among other things, it was used as a clarifying agent for wines and in plasters and glues. He transferred the smoky images onto squares of isinglass and sent them off with a second explanatory manuscript to the Paris Academy of Sciences in September 1851. With this, Helmholtz won the recognition he desired. Ironically, the published manuscript did not include the images.

Last year, Schmidgen was studying correspondence between Helmholtz, Du Bois-Reymond and the Paris Academy of Sciences when it occurred to him that the paragraph that referred to the curves in the draft manuscript was missing from the printed paper. There was no way of knowing whether Helmholtz had decided not to send the curves after all, or whether the academy had simply not printed them. Unless, by chance, the publishers had simply kept the curves in the file. Schmidgen flew to Paris to see. And this is how he made the kind of discovery of original material that science historians dream of. ■

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