

Book Review

Isaac Newton

Reviewed by Steven G. Krantz

Isaac Newton

James Gleick

Pantheon Books, 2003

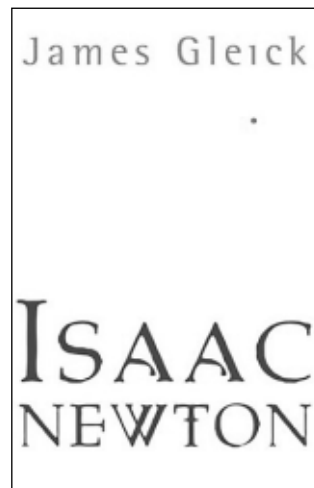
288 pages, \$22.95

ISBN 0375422331

James Gleick is a remarkable individual. An English major at Harvard University, his first adventure after college was an attempt to start up a newspaper. That failed, and he eventually moved into news reporting. He was a staffer for the *New York Times* for several years, and his rotation among various jobs at the *Times* led to his exposure to a good deal of interesting scientific activity. And then Gleick did a noteworthy thing: he *synthesized* everything that he had been seeing and hearing—the disparate works of Yorke and Feigenbaum and Hubbard and Mandelbrot and others. Gleick realized that the melange he had described was “chaos” (a word that had already been used in the literature), and he wrote a best-selling book [GLE1] on the subject.

Whatever you may think of chaos as a subject (and I happen to think it is little more than a random sequence of ejaculations), it is difficult to gainsay the fact that Gleick’s book has accomplished quite a lot, garnered a good bit of attention for a notable slice of modern scientific activity, and virtually spawned a literary *genre* (i.e., the current spate of popular scientific writing). Gleick’s

Steven G. Krantz is professor of mathematics at Washington University in St. Louis. His email address is sk@math.wustl.edu.



success with that first book is well deserved. It allowed him to retire to a big house in Brooklyn and to become a full-time writer.

Gleick’s second book [GLE2], almost as important as the first, was a biography (the first ever) of the noted physicist Richard Feynman. Gleick had a tricky path to walk because Feynman had already

told his story himself (in a pair of charming books [FEY1], [FEY2]). Of course Gleick did not want simply to repeat all the *bons mots* that Feynman himself had already shared with us. But he could not very well omit them all either, since they were some of the highlights of Feynman’s life and career. Gleick carried off the job with élan and grace, and this second book was also a considerable success.

I might note that I have spent time with James Gleick and talked to him at length about chaos and other scientific issues. It is safe to say that Gleick does not know much, nor does he profess to know much, about science. But he is an excellent listener and a talented reporter. The proof is, after all, in the pudding. Gleick gave a public lecture about chaos at my university a few years ago.

It was an astonishing performance—enlightening, entertaining, and insightful.

Now Gleick has turned his hand to a biography of Isaac Newton. I must say that I was a bit surprised. After all, Newton has been dead for 275 years. He was, by all estimations, our greatest scientist. His life has been chewed over extensively, and there are plenty of biographies. Why do we need another? Why doesn't Gleick write a biography of Stephen Wolfram (of whom there is no biography and who has led a fascinating life) or William Shockley (same comment)? But we mustn't sell Gleick short. He is a keen observer and a good storyteller. He always has a fresh take on things. And *Isaac Newton* does not disappoint.

It is well-documented and oft-told that Isaac Newton was an irascible, unsociable, solitary man who had neither parents (in the sense that he lived with neither of them) nor friends nor spouses nor lovers. He died a virgin. One of the most famous Isaac Newton quotations is "I do not know what I may appear to the world but, to myself, I seem to have been only like a boy playing on the sea-shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me." Yet James Gleick points out that Isaac Newton almost certainly never saw the seashore.

Newton rarely published his results and never did so in a timely manner. He conducted savage feuds with other scientists who he felt had wronged him. There seems to be little doubt that the long-running rift between the Leibniz partisans on the continent and the Newton partisans in England over the primacy to the calculus was due in no small part to Newton's secretiveness. But Gleick concentrates on a different feature of the life of Newton. The scientist's youth, and the incipient thought processes that made for a great historic analytical genius, seem to have been less thoroughly studied over time. Newton's state of mind while he was writing the *Principia* has not been heretofore carefully documented. It is these aspects of Newton's life that Gleick chooses to develop in detail.

Gleick tells of how, when he was young, Newton had very little *paper*. And, even while at Cambridge, his access to books was extremely restricted. We are told that, when the young man finally did get a notebook, he filled its pages with minute recordings of recipes for ink, with speculations about nature, with calculations, and with philosophical musings. Newton took great pleasure, even as an adult, in copying classical texts word for word—just as did the ancient Greeks. Isaac Newton's father died before the scientific genius was born, and his mother had to abandon the child in order to marry another man. Thus, even though his mother had considerable means, Newton had to attend Cambridge as a subsizar—basically a servant

to the other students. He studied with Isaac Barrow, who was the first professor of mathematics that Cambridge ever had. When Newton inherited a 1,000-page bound vellum notebook from his stepfather, it changed his life. For now he could *really* write!

Of course the plague epidemic was the best thing that ever happened to Newton. Schooling at Cambridge was disbanded in order to limit contagion, and the young genius was forced to repair to the country for twenty months (in 1664 and 1665 by our modern calendar)—a period during which young Isaac had limitless stretches of uninterrupted time for concentration and reflection. He labored away at the 1,000-page notebook that he had inherited and which he called his "Waste Book". It was in this single notebook that Newton carried out the calculations that became calculus, the theory of infinite series, mechanics, optics, and myriad other key ideas of modern science.

It is difficult, from our modern Olympian perspective, to understand the mindset of Newton's day. Even the concept of "velocity" was relatively new at that time. While Newton was inventing mechanics, he was also inventing the very *language* in which it is expressed. And Newton's great nemesis, in all his ruminations, was the concept of infinitesimal. He constantly had to confront Zeno's paradox, and the many apparent contradictions arising therefrom, in all his considerations of fluxions and fluents and quadrature and acceleration. Some representative passages taken from Newton's grappling with the notion of infinitesimal give a flavor of his struggles:

Thus $\frac{2}{0}$ is double to $\frac{1}{0}$ & $\frac{0}{1}$ is double to $\frac{0}{2}$,
for multiply the 2 first & divide the 2^{ds}
by 0, & there results $\frac{2}{1} : \frac{1}{1} & \frac{1}{1} : \frac{1}{2} \dots$

(that is undetermined)

Tis indefinite \wedge how greate a sphære
may be made how greate a number may
be reckoned, how far matter is divisible,
how much time or extension wee can
fancy but all the Extension that is, Eternity,
 $\frac{a}{0}$ are infinite.

It is safe to say that Isaac Newton never fully came to grips with the notion of infinitesimal, but he made peace with it well enough to develop the science that he wanted to develop.

It has frequently been argued—and it is easy to do so—that a good historian of science should have considerable knowledge of history and also considerable knowledge of the sciences. I am fairly sure that James Gleick is no master of Isaac Newton's science. And his pedigree is also not as a historian. But he is a gifted writer, he is a quick

study, and he is *very careful*. His book is painstakingly researched and copiously footnoted. His list of references is more than impressive. And he says himself that his driving force in writing this book was to work from the primary texts. The result is a beautiful work and a delightful read.

It is clear, as one works one's way through the text, that when Gleick describes calculus, he is delicately dancing around things that he does not thoroughly understand. But he is scholarly and exact. As he indicates in his acknowledgments, he had many good people checking his accuracy and his credence. One is tempted to compare this book (very favorably!) with Sylvia Nasar's biography of John Nash [NAS]. Many of the statements that Nasar makes about mathematics (such as her formulation of the fundamental theorem of algebra) are incorrect. And it would have been so easy for her or her publisher to hire a proofreader. Gleick is a bit more careful, and the mathematical reader is considerably more comfortable with his result.

In all, I am very happy indeed that James Gleick wrote this book. Unlike some of the other modern treatments of Newton's life (see, for instance, [WES]), Gleick's life of Newton is neither ponderous nor prolix. It moves along rapidly but carefully and gives one a great and glorious sense of the age of enlightenment and of Isaac Newton's role in it.

Gleick pulls no punches in recounting Newton's fisticuffs with Robert Hooke, with Gottfried Wilhelm von Leibniz, and with other scientific luminaries of the day. He treats Newton's periodic descents into near madness with delicacy but precision. He in no sense paints Isaac Newton as a saint, but rather as a very gifted man with very human frailties.

Since Gleick does not come from the culture of mathematics and holds perhaps different values from the typical *Notices* reader, he makes some choices that we may find surprising. He mentions Newton's famous solution of the brachistochrone problem only in passing. In fact the word "brachistochrone" is never used, and the problem is never described; Gleick refers to it only as an "esoteric geometry problem." Hah! Stories like this are part of our hagiography. We do not want to see them lost in the shuffle. On the other hand, Gleick *does* pay suitable homage to the legend of Newton's derivation of Kepler's laws from the universal law of gravitation—that Newton solved it and forgot about it until Edmond Halley pried it out of him in a much later conversation.

One could fault Gleick, if one were wont to do so, for shortchanging certain very interesting aspects of Newton's story. For example, Newton willed a huge chest, containing all his scientific papers, to Catherine Barton (a niece who kept house for him). The tale of what became of those papers, how—at the hands of a fascist heir—they became scattered to the winds at an ill-conceived auction

held to raise money for the Führer's cause, and how (due to the efforts of John Maynard Keynes and others) they were mostly reassembled is a fascinating tale that Gleick does not attempt to treat.¹ However, Gleick had to make certain shrewd decisions to keep his tale to 191 brisk pages. I think that he did well and has left us with an enlightening and inspiring saga that will educate student and scholar and layman alike. One can only look forward to James Gleick's next scholarly enterprise.

References

- [DYS] F. DYSON, Review of *Isaac Newton* by James Gleick, *New York Review of Books*, July 3, 2003.
 [FEY1] R. FEYNMAN, *Surely You're Joking, Mr. Feynman!*, W. W. Norton, New York, 1985.
 [FEY2] _____, *What Do You Care What Other People Think?*, W. W. Norton, New York, 1988.
 [GLE1] J. GLEICK, *Chaos: Making a New Science*, Viking, New York, 1987.
 [GLE2] _____, *Genius: The Life and Science of Richard Feynman*, Pantheon Books, New York, 1992.
 [NAS] S. NASAR, *A Beautiful Mind*, Simon & Schuster, New York, 1994.
 [WES] R. WESTFALL, *Never at Rest: A Biography of Isaac Newton*, Cambridge University Press, Cambridge, 1980.

¹But see Freeman Dyson's review of this same book in [DYS].