velopments and the years around 1900. Germany, the home of the *Handbuch*, the textbook, and many of the world's leading scientific journals, does not receive a separate essay.

Knight's survey is a useful introduction despite his odd opinions that "octavo" signifies a sheet folded eight times and that Sadi Carnot's book on thermodynamics was directed to the general public. Among much else, he mentions consequences of improving printing technique and rightly emphasizes the introduction of wood engravings (as opposed to woodcuts) around 1800. Katzen also discusses format and technique, taking as example the typography, layout, and size of the *Philosophical Transactions* over 300 years. She presents much useful information, but her efforts to identify important developments in the history of science from the changing physical makeup of the journal do not appear promising.

Probably the most valuable for readers of *Science* are the essays concerned with Victorian practice and those dealing with events after the Second World War. In the first group Meadows discusses efforts to gain access to the rapidly multiplying literature through creation of abstract journals and bibliographies. He mentions the Royal Society's catalogue of 19th-century literature and characteristically omits the no less serviceable *Handwörterbuch* of the immortal Poggendorff. Meadows also attends to the lower end of the dissemination, and gives interesting statistics on borrowing patterns in public libraries and mechanics' institutes.

MacLeod takes this theme further in a workmanlike account of the early successes and ultimate failure of the series of high-level popularizations inaugurated in the 1870's by the American E. L. Youmans, founding editor of *Popular Science Monthly*. Among the causes of decline that MacLeod enumerates was the increasing reluctance of distinguished scientists to write for general audiences. The same problem weakened the *Monthly* and aroused concern in the general press. The reluctance persists, especially in Anglo-Saxon countries; in place of T. H. Huxley, J. Tyndall, and H. N. Moseley we have professional intermediaries, science reporters, and Carl Sagan.

In the last solid essay on a Victorian theme, Brock discusses commercial journals, particularly the *Philosophical Magazine (PM)*, and the several "taxes on learning"—duties on paper, taxes on periodicals, high postage—that obstructed publishing in Britain until 1860. According to Brock, the press run of *PM* remained at about 750 copies from 1844 until after 1900. The *PM* was one of the two top physics journals in the world in 1900; its circulation is a good gauge of the size of the profession. From other studies it appears that the number of academic physicists in the world in 1900 was less than twice the press run of *PM*.

In the last group of essays, Dixon raises the question of the responsibility of newspaper science writers. He gives data about the increase in newspaper coverage of science and about attempts of scientists to manipulate the press. In a striking reversal of the usual argument, he observes that in many instances alert questioning by reporters has caused scientists to moderate or withdraw hasty claims. Still, few newspapers besides the *New York Times* and *Le Monde* have the large and specialized staff needed to vet professional pretensions, and pressure for quick publication, acting on scientists and reporters alike, continues to bring forth premature revelations.

The book concludes with descriptions of the rise of international commercial journals in Britain (Meadows) and the Netherlands (Leeuwen) as a counter to American dominance in scientific publishing after the Second World War. The great increase in costs in the 1970's affected European journals more seriously than their rivals. Retrenchment has been necessary, and, we hope, sufficient, to ensure that this first centennial of the new Elsevier will not also be its last.

J. L. HEILBRON
Office for History of Science and Technology, University of California, Berkeley 94720

Cattell: The Beginnings of a Career

An Education in Psychology. James McKeen Cattell's Journal and Letters from Germany and England, 1880–1888. MICHAEL M. SOKAL, Ed. MIT Press, Cambridge, Mass., 1981. xxviii, 372 pp. $30.

In July 1880—the month the first issue of *Science* appeared—young James M. Cattell sailed for Liverpool from Philadelphia. Leaving his parents for the first time, pursued by depression, without any clear direction, but also "eager to speak to everyone" aboard ("the ladies always excepted"), the 20-year-old set out to seek his fortunes in Europe. Eight years later he returned, having "nearly everything I wish": a German Ph.D., an English bride, a new professorship in psychology at Pennsylvania, and an invitation to return to Cambridge, where he had hobnobbed with the intellectual elite. (After another six years, he was to acquire a defunct *Science*, revitalize it, and run it for half a century.) The intriguing story of these eight Wanderjahre is told in *An Education in Psychology*, mostly in Cattell's own words as recorded in his journal and letters to his parents (along with some of their replies), with transitional sections by the editor, Michael M. Sokal.

It is not quite the rags-to-riches story of a long-lost child. Cattell returned home four times, once for a year's study at Johns Hopkins; he also traveled with his parents in Europe. Born with at least

MR. FRANCIS GALTON'S ANTHROPOMETRIC LABORATORY.

The laboratory communicates with the Western Gallery containing the Scientific Collections of the South Kensington Museum. Admission to the Gallery is free. It is entered either from Queen's Gate or from Exhibition Road.

Date of Measurement.	Initials.	Birthday. Day.	Birthday. Month.	Eye Color.	Sex.	Single, Married, or Widowed?	Page of Register.
11 Aug 88	J M K	25	6	Grey	M	Single	626

Head length, maximum from root of nose.	Head breadth maximum.	Height standing, less heels of shoes.	Span of arms from opposite finger tips.	Weight in ordinary clothing.	Strength of squeeze. Right hand.	Strength of squeeze. Left hand.	Breathing capacity.	Keenness of Eyesight. Distance of reading diamond numerals. Right eye.	Keenness of Eyesight. Distance of reading diamond numerals. Left eye.	Snellen's type read at 20 feet.	Color Sense.
Inch. Tenths.	Inch. Tenths.	Inch. Tenths.	Inch. Tenths.	lbs.	lbs.	lbs.	Cubic inches.	Inches.	Inches.	No. of Type	? Normal.
7 7	5 8½	66 7	68 9	144	89	82	238	16	12	20/18	Yes

Height sitting above seat of chair.	Height of top of knee, when sitting, less heels.	Length of elbow to finger tip left arm.	Length of middle finger of left hand.	Keenness of hearing.	Highest audible note.	Reaction time: To sight.	Reaction time: To sound.	Judgment of Eye: Error in dividing a line of 10 inches in half	Judgment of Eye: Error in dividing a line of 10 inches in thirds	Judgment of Eye: Error in degrees, estimating an angle of 90°	Judgment of Eye: Error in degrees, estimating an angle of 60°
Inch. Tenths.	Inch. Tenths.	Inch. Tenths.	Inch. Tenths.	? Normal.	Vibrations per second.	Hundredths of a second.	Hundredths of a second.	Per cent.	Per cent.		
34 8	21 1	17. 7	4. 3	Yes	19.000	30	20	0	3	1	10

One page of the Register is assigned to each person measured, in which his measurements at successive periods are entered in successive lines. No names appear on the Register. The measurements that are entered are those marked with an asterisk (*). Copies of the entries can be obtained through application of the persons measured, or by their representatives, under such conditions and restrictions as may be fixed from time to time.

"Cattell's record at Galton's anthropometric laboratory." [From the Cattell papers, Library of Congress; reproduced in *An Education in Psychology*]

a silver-plated spoon in his mouth, he could pay a fellow candidate in Wundt's lab for help with his experiments (making sure, as his father had impressed on him, to avoid claims to coauthorship) and another student to grind out the calculations. (Later, taking stock of his baggage in Cambridge, he counted 15 suits and 20 pairs of footwear.) And most importantly, his father, president of Lafayette College, was pulling strings incessantly, and successfully, during these years to promote his son's career.

Still, though floundering initially and troubled by attacks of Weltschmerz, Cattell had been quick to seize opportunities. Only weeks after first stepping into a psychology laboratory (in Baltimore), he thought up an experiment that was later published. After only one month in Wundt's lab in Leipzig, he designed a novel piece of apparatus enabling him to carry out his Ph.D. research. Worried one year about producing acceptable work, he had Wundt "willing, indeed anxious" to publish his research the next. It appears also that Wundt, on his own initiative, made Cattell his first Assistent—contrary to the story repeated in most histories of psychology, that Cattell had gone to Wundt and said: "Herr Professor, you need an assistant. I will be your assistant."

This anecdote appeared first in English in E. G. Boring's magnum opus, *A History of Experimental Psychology* (1929; second edition 1950), long the standard source on this subject. The major part of Boring's work, for a book covering the psychology of two centuries and two continents, was done in one year. Sokal's book, dealing with eight years in the life of a single psychologist, is the fruit of a decade of work—standards of scholarship in the history of psychology have changed in a few decades. The change was brought about largely by a handful of professional historians (and a few psychologists) willing to take the history of psychology seriously and involved, among other things, the idea of archival research and the need for a critical perspective on sources.

Yet the book is certainly not just for psychologists. In fact, the technical material is fairly limited. As Sokal's introduction points out, the documents bear on several topics in the intellectual and social history of the period. And Cattell was an important man, involved not only in early psychology but also in the organization of science and in debates about faculty governance and academic freedom in America. The book is not always easy reading (though surely easier than deciphering hundreds of handwritten letters). It is helped, at least most of the time, by extensive scholarly footnotes provided by Sokal, who winnowed 1600 documents down to the 400 printed—surely a labor of love of the subject matter if perhaps not of the subject. The effect of this selective process is hard to judge, although one wishes at times that some other material had been added. And one discovers, again, that even such extensive personal documents do not tell the whole story.

In fact, several issues of importance to historians of psychology remain unresolved, though Sokal supplies some information and opinion, for example concerning Cattell's metaphysical views, where Sokal's label of "physicalism" does not quite convince me; or on the "Galton connection," that is, Cattell's early contacts with Galton's work and their impact on his interest in individual differences, although here Sokal and the documents convince me that Cattell did not bring, ganz amerikanisch, this interest full-blown from Baltimore to Leipzig (another standard textbook story shown to be an "origin myth"); and most of all the as yet unexplained mystery, how a fledgling experimental "psycho-physic" could muster the support to equip laboratories and establish positions at a time when the "hard" experimental sciences had only a toehold in American universities and psychology had produced only the most esoteric bits of information. The notion that practical interests produced such investment seems problematic, in view of recent claims that even hard-science research aroused serious interest in only a few industries of the period. Following Sokal's hint about England, one wonders what role wealthy donors' concerns with spiritualism, psychic research, and the like played in the funding (though not founding) of the "new" psychology. Cattell's chair at Penn was not the only one to receive funds from such sources.

Finally the last mystery: Cattell the man. Here readers are explicitly left to their own devices. A brief postscript outlining Cattell's life after 1888 ends the book rather abruptly. Though the original documents make extremely interesting reading and provide valuable source material for historians, Sokal's self-effacement seems regrettable. One can only hope that a further volume will give us in more explicit form the benefits of his intimate familiarity with the life of James McKeen Cattell. In the meantime, the present volume gives us plenty of material for speculation.

FRANZ SAMELSON
Department of Psychology, Kansas State University, Manhattan 66506

Hamilton

Sir William Rowan Hamilton. THOMAS L. HANKINS. Johns Hopkins University Press, Baltimore, 1980. xxii, 474 pp., illus. $32.50.

Sir William Rowan Hamilton (1805–1865), the most eminent of Ireland's contributors to mathematics and science, has had two biographers. In 1882, the Reverend Robert Perceval Graves, Hamilton's countryman and friend, published the first volume of his massive *Life of Sir William Rowan Hamilton*, which eventually ran to over 2100 pages. Now Thomas L. Hankins has followed with a second. In his biographers Hamilton has been doubly if differently fortunate. Whereas Graves's three volumes were in the chronological life and letters mode, laudatory but not lavishly so, honest but within the limits of Victorian decorum, and giving only such attention to the technicalities of Hamilton's creative work as an erudite clergyman might manage, Hankins's biography is analytic, more concise but comprehensive, and ambitiously aimed at integrating all the facets of Hamilton's richly productive but troubled life.

To a correspondent Hamilton once wrote: "I am most anxious that in Dublin I should be looked upon as a perfectly prosaic person, with not a bit of the romantic about him, whereas in fact my life has been a romance." So Hamilton envisioned it; so it was; and thus does Hankins present it.

Master (according to his father) of a dozen languages at 10, orphaned at 14, Astronomer Royal of Ireland and Andrews Professor of Astronomy at Trinity College, Dublin, at 21, married at 27 to the almost continuously ill Helen Bayly, knighted at 30, designated in 1863 the greatest living scientist by America's new National Academy of Sciences, Hamilton died in 1865 with a cabinet full