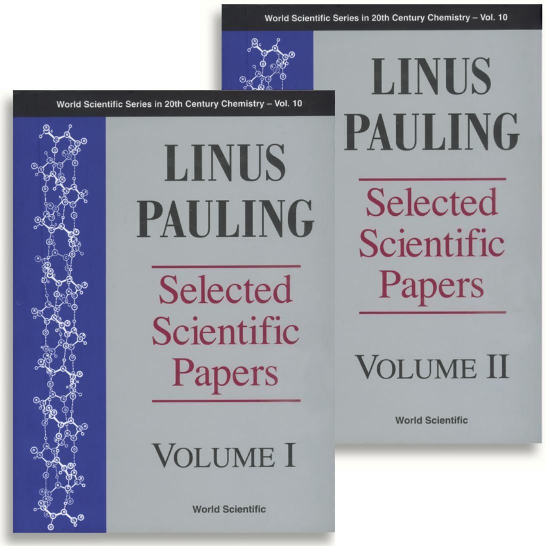
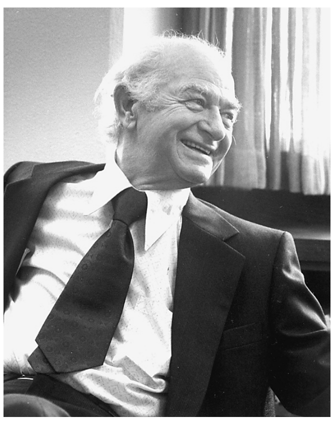


Linus Pauling: Selected Scientific Papers

World Scientific, 2001; 1,573 pages



Pauling at Caltech in 1974.

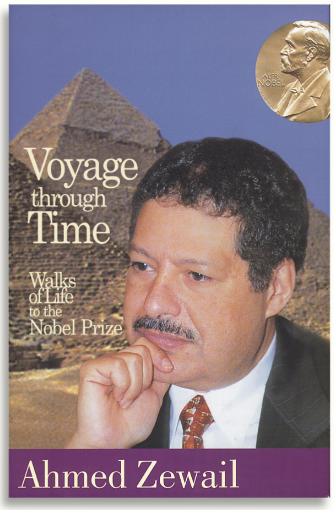
When the World Scientific Publishing Company contacted Linus Pauling shortly before his death to propose publishing a selection of his scientific papers, Pauling is reported to have said (according to his son Peter): "The selection is easy—print them all." Wisely, his children, who had agreed to act as editors, concurred with the publisher that this would generate a daunting number of volumes and a prohibitive price. So the resulting *Linus Pauling: Selected Scientific Papers* contains only 144 of his most important writings (out of about 1,200) produced between 1923 and 1994. Even so, it runs to 1,573 pages in two volumes (and $240).

The project has remained a family enterprise. Editors are Barclay Kamb, the Rawn Professor of Geology and Geophysics, Emeritus, who acted as editor-in-chief; Linda Pauling Kamb, who was the photo editor and curator of the original publications; and Peter Jeffress Pauling, Alexander Kamb, and Linus Pauling Jr., each of whom edited a section. Also involved in the selection of the papers was an impressive bank of advisers (including, from Caltech, chemists Richard Marsh and Ahmed Zewail and biologists Justine Garvey and Ray Owen). The selection, according to the editors, "aims to present Pauling's most important and influential scientific papers and the papers that best convey his imaginative style of scientific thinking and the considerable gamut of scientific subjects that he tackled."

Divided into four parts, the papers are grouped by subject matter: the nature of the chemical bond; the atomic structure of molecules and crystals (along with quantum mechanics); the structure and function of large molecules of biological importance, particularly proteins; and biomedical subjects. Each part is subdivided into chapters; the relationship of the chapters to one another and the significance of the individual papers are explained in the introduction to each part. All the papers are reproduced in facsimile from their original sources.

The volumes also contain a substantial collection of photographs and a short biography originally written for the Royal Society of London by Jack Dunitz (who notes, in addition to a summary of Pauling's scientific achievements, such things as his "seraphic smile"). And if you really want to know *all* the papers Pauling wrote, they're listed in Appendix III; the list alone takes up 58 pages.

Ahmed Zewail, the Pauling Professor of Chemical Physics and professor of physics, wrote the foreword, in which he compares Pauling's stature in chemistry to the Great Pyramid of Cheops. This anthology represents, he writes, "a monumental contribution—a must for chemists, biologists, and scientists in general who want to understand the roots of important concepts in modern science, the foundations for which were laid down by Linus Pauling."



Voyage through Time: Walks of Life to the Nobel Prize

by Ahmed Zewail
The American University in Cairo Press, 2002; 287 pages

As he explains in his recent autobiography, Ahmed Zewail has, like Harry S. Truman, "tried not to forget who I am and where I came from." And *Voyage through Time: Walks of Life to the Nobel Prize* tells us. Throughout, the book is infused with the influence of his Egyptian background, which a third of a century in the United States has not erased—the songs of Um Kulthum, which he has loved since childhood; his pride in the contributions of Arab scientists throughout history, particularly the relevance to his own work of Alhazen, who worked with light and optics in the 11th century; and even the point that "chemistry" derives from an Arab root word.

Zewail writes evocatively of his boyhood in Desuq, a Nile town near Alexandria, of his science education at the University of Alexandria (which had a new spectrophotometer but no lasers), and of his decision to attend graduate school in America, following in the footsteps of teachers he admired. He describes the excitement of coming to the University of Pennsylvania in 1969, the culture shock (he wore a suit and tie to the lab at first), his broken English (once ordering a "desert" instead of "dessert"), and the scientific shock of all the new and complex instrumentation. After finishing his PhD in 1973, he almost returned to Alexandria, but could not resist the lure of the "high-powered" labs that were courting him as a postdoc. He landed at Berkeley, where yet another culture shock awaited (hippies, streakers), as well as the unfamiliarity of big science and big funding. But again he assimilated and decided to make his career in America.

Caltech recruited him as an assistant professor in 1976, beating out other big-time suitors. He was a bit concerned about Caltech's "lack of enthusiasm" for chemical physics, but opted anyway for a place he considered the "mecca of science." He was granted tenure after two years.

Plenty of pages are devoted to Zewail's scientific work—the steps leading up to the birth of femtochemistry in 1987 and the Nobel Prize in 1999 for using femtosecond laser pulses to catch chemical reactions in the act, breaking and forming bonds between atoms. But any regular reader of *E&S* probably already knows about Zewail's science. It's the personal side revealed here that makes for fascinating reading.

The book is lavishly illustrated. We see not only the much-honored scientist with his family and diverse important people, but also the 10-year-old Ahmed on the beach with his father, the serious boy in primary-school art class, and the scorecard that the young postdoc plotted to choose Caltech over Harvard, Chicago, Rice, and Northwestern.

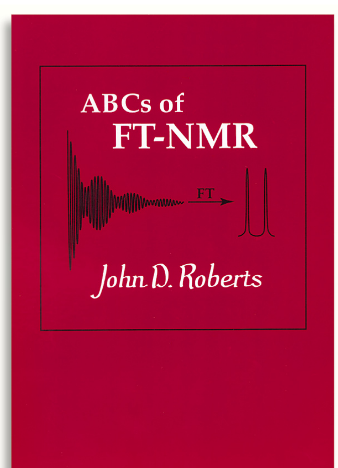
Zewail feels that as a scientist equally at home in two different cultures (he holds dual Egyptian and American citizenship), he is in a unique position to help foster science for the "have-nots." At the end of the book he makes a "proposal for partnership" between the developed and developing worlds, a sort of Marshall Plan for science. He believes strongly that developing countries must create "centers of excellence" and to that end is intensely involved in planning for the University of Science and Technology in his homeland. The UST sounds a lot like Caltech—a mecca of science. *—JD*

ABCs of FT-NMR

by John D. Roberts
University Science Books, 2000; 336 pages

Nuclear magnetic resonance (NMR) spectrometers can identify molecular structure, follow reaction kinetics, and study enzyme mechanisms. The Fourier-transform (FT) version is a top-of-the-range model that detects very weak signals by analyzing the spectra of the sample over and over again, the way a camera takes a picture in dim light using a long exposure time. But, cautions the author, don't regard the FT-NMR spectrometer as a "black box" instrument. Relying on the preset FT-NMR analyses could give you the wrong results and you'd never be any the wiser; worse still, they could give you no results at all when they are there to be had.

Aware that for most chemists and biologists the prospect of learning about FT-NMR is a daunting one, the scope of this book has been kept broad rather than deep, the explanations qualitative rather than quantitative, and the math—where unavoidable—simple. The author (now Institute



Professor of Chemistry, Emeritus) was one of the pioneers of NMR spectroscopy over 40 years ago, though he modestly claims to be "a ranking nonexpert." As the set text for the basic FT-NMR course, this book has been tried and tested by 10 generations of Caltech students and teaching assistants and, in response to their feedback, revised almost annually (this is the ninth edition), to make sure that the explanations of complex NMR phenomena are as simple as possible. It's not airplane reading (unless you really want to take your mind off the flight), but it's a gentle guide through a difficult subject written with great charm and delightful humor. If you use FT-NMR spectroscopy in your work, you need to read this book. The good news is, you'll enjoy it.—*BE*

A Hundreth Sundrie Flowres

by George Gascoigne, edited by G. W. Pigman III
Clarendon Press, Oxford University Press, 2000; 781 pages

George Gascoigne (c. 1534–77) is not exactly a household name. A perennial wannabe at the court of Queen Elizabeth, he spent a dissipated youth, was trained in the law (which came in handy for the many lawsuits—bigamy, debt, theft—that pursued him), failed at farming, sat briefly in Parliament, went to war in the Netherlands to flee his creditors, and finally, in the last years of his life, was hired by the members of the court to write a couple of masques and pageants for the queen. He also wrote the first Italian-style comedy in English, as well as the first English adaptation of a Greek tragedy, and some of the first English sonnets and a "proto-novel." He was a literary pioneer, but was unlucky to be overshadowed by the famous Elizabethans who studied (Sidney and Spenser) and plundered (Shakespeare) his work.

Gascoigne never vanished completely from the radar screen, and editions of his work appeared sporadically in the 18th and 19th centuries. A *Complete Works* was published in 1907–10. Now, Professor of Literature G. W. (Mac) Pigman has published an edition of Gascoigne's major achievement, *A Hundreth Sundrie Flowres*, which contains a collection of plays (*Supposes*, the Italian comedy, and *Jocasta*, after Euripides), prose (*The Adventures of Master F. J.*), and poems, many of them purportedly written by "sundrie gentlemen," but all, in fact, by Gascoigne himself. His own description on the title page reads: "A Hundreth Sundrie Flowres Bounde up in One Small Poesie. Gathered partely (by translation) in the fyne outlandish Gardins of Euripides, Ovid, Petrarke, Ariosto, and others: and partly by invention, out of our owne fruitfull Orchardes in Englande: Yielding sundrie sweete savours of Tragical, Comical, and Morall Discourses, bothe pleasaunt and profitable to the well smellyng noses of learned Readers."

This new edition, wrote a reviewer in the *London Review of Books* "is the best piece of luck Gascoigne has had in the four hundred and fifty years since his birth." And the *Times Literary Supplement* noted: "If anything deserves to bring George Gascoigne back into the spotlight of serious attention, it is this judicious and scholarly edition. . . . G. W. Pigman's *A Hundreth Sundrie Flowres* is a worthy addition to the Oxford English Authors series and is a reminder of just how valuable responsible editing can be."

Pigman's responsible editing includes 277 pages of learned, line-by-line commentary on sources, meanings, allusions, translations, and history. And his textual introduction tackles a problem that has vexed scholars for centuries (Gascoigne's book "is one of those bibliographical eccentricities which it seems hopeless to explain," said one): that is, which edition of the work, the 1573 one (which was "deemed lasciviously offensive") or the cleaned-up, reorganized, and supplemented 1575 version, should be recognized as the authoritative copy-text. With sound textual arguments, Pigman opts for the earlier, while paying all due respect to the later one.

Again from the *London Review of Books*: "Here, almost spotless, is almost anything a reader of Gascoigne could desire to know, in what must be one of the best editions of an early modern text produced in the last decade."

Unjust Seizure
Conflict, Interest, & Authority in an Early Medieval Society

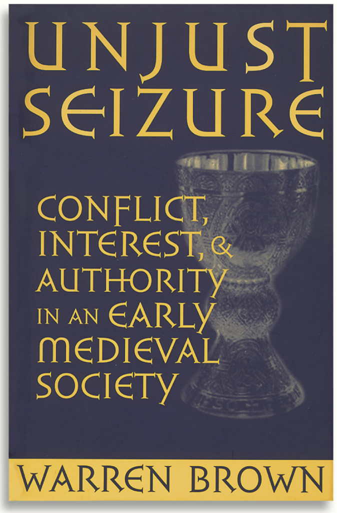
by Warren Brown
Cornell University Press, 2001; 224 pages

This book is about political power and how it functions in the affairs of a feudal society before and after a new government takes over. No, it's not about 21st-century Afghanistan, but 8th- and 9th-century Bavaria, where Warren Brown, assistant professor of history, has focused his research on conflict resolution—on the authority claimed by rulers to settle disputes, the institutions established, and the reaction of the populace to a change in those institutions.

His research was aided by a rich trove of documents in the Bavarian town of Freising. There, in the middle of the 9th century, a priest collected and copied the cathedral archives of the previous hundred years—archives that recorded all the local property disputes, many of which involved the church and its monasteries. Over those hundred years, the Bavarian ducal authority gave way to conquest by the Franks under Charlemagne, who tried to introduce a central authority to rule over a land that was a long way down the legal supply route. The stories from the cathedral archives leave a clear written record of real-estate wrangling before and after the arrival of "the new sheriff in town."

The local dukes were the Algilofing family, who had ruled with quasi-royal authority since the 6th century. Brown describes several cases from the mid-8th century, in which feuding landowners, who had resorted to violence, were required to deed property to the church—perpetrators and victims alike. Inheritance of property was another source of conflict in which the church often ended up the winner. Things sometimes got sticky for the church, however, because Bavarian law still allowed aristocrats a substantial amount of control of donated property, a custom the bishops did not have the power to challenge.

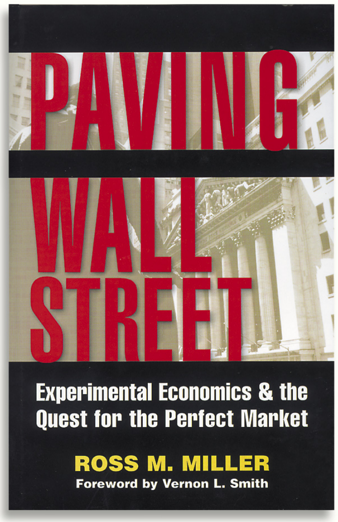
This cosy arrangement changed with the Carolingian takeover, beginning in 791. The duke was no longer a player, bishops gained much more clout, and officials of a formal Carolingian judicial system entered the picture. Suddenly (even without lawyers) the disputes recorded in Freising mushroomed. This was not primarily due to a centralized judicial apparatus



exported by the Franks, says Brown, but rather to a couple of powerful bishops who assumed the mantel of Charlemagne's prestige and gave the appearance of centralized authority to which the populace could appeal. After Charlemagne died in 814, disputes over real estate reverted to a more informal mode, and Brown's final chapter is entitled "The Art of the Deal."

Lively case studies from the Freising archive throughout the book paint a vivid picture of medieval life. "The Tale of Kyppo's Pig" and the intra-family bickering over deeds to the church from a landowner named Toto and his sons, Scrot and Wago (there's a new wife involved), make for an enjoyable read. And the story of the bishop who took the blame for impregnating a duke's daughter to spare her lover, and then was mutilated and slaughtered by her brother, has enough gory detail for any modern movie. At least the bishop was ultimately proclaimed a saint.

An article by Warren Brown, "What's 'Middle' About the Middle Ages?" appeared in *E&S*, No. 2, 2000.



PAVING WALL STREET
EXPERIMENTAL ECONOMICS & THE QUEST FOR THE PERFECT MARKET
by Ross M. Miller
John Wiley & Sons, Inc., 2002; 314 pages

How do financial markets work? And if we knew, would we all be rich? Probably not, as demonstrated by the 1998 Long-Term Capital Management debacle involving a hedge fund that operated on the arbitraging theories of economics Nobel Prize-winner Robert Merton (MS '67, applied mathematics).

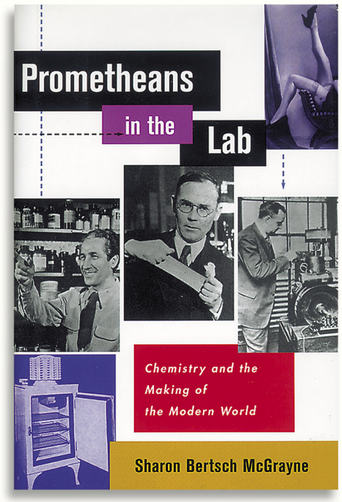
But academic economists want to know anyway. Ross Miller's book *Paving Wall Street: Experimental Economics & the Quest for the Perfect Market* traces the attempts over the last half century to determine precisely how Adam Smith's "invisible hand" moves its fingers and why markets behave the way they do. Along the way he examines and explains such phenomena as bubbles, the stock market crash of October 1987, derivatives, options, California's energy deregulation—and hedge funds.

Miller earned his BS ('75, mathematics) from Caltech, where he participated in Vernon Smith and Charles Plott's pioneering 1974 seminar "Laboratory Methods in Social Science," when he wasn't hanging out at a local brokerage. He admits in his preface that "because Vernon, Charlie, and their Caltech colleagues got to me first, everything that I have seen in the academic and corporate worlds has been filtered through the lens of experimental economics."

Smith (BS '49, electrical engineering, and Distinguished Alumni Award '96) and Plott are generally recognized as the founders of this field, which overturned the assumption that economics was, like astronomy, a purely observational discipline. Smith first encountered rudimentary experiments (in which "living, healthy, human subjects" simulated a competitive market) in graduate school at Harvard, and then took them to a new level in 1956 in his own courses at Purdue, where he met Plott. In testing the laws of supply and demand, Smith also used real cash, sometimes his own, to provide a genuine economic incentive. In his double oral auction, student "buyers" and "sellers" bid amounts that quickly converged to an equilibrium price.

Caltech became the center of experimental economics in the early ’70s, Plott (currently the Harkness Professor of Economics and Political Science) having joined the faculty in 1971 and Smith returning as a Sherman Fairchild Distinguished Scholar in 1973. “The two of them, along with many of Caltech’s other social scientists, soon turned Caltech into a hotbed of experimentation on how groups made decisions.” Miller describes his own and others’ work on speculation and bubbles in a controlled laboratory, before routing the rest of his narrative to Wall Street (in a chapter entitled “Bubbles in the Wild”) and taking readers on an entertaining and enlightening ride with not a single equation in sight.

Toward the end of the book, the author travels beyond financial markets to describe experimental work in other markets, such as allocating landing slots at airports, dividing up the broadcasting spectrum, and assigning space on the Space Shuttle—all of them problems studied in Caltech’s laboratories by former and current faculty members, including Professors John Ledyard, David Grether, Tom Palfrey, and Colin Camerer. Says Camerer, the Axline Professor of Business Economics: “The style [of the book] is a refreshing combination—dramatic and fun to read, but also historically and scientifically accurate. So, I can send one to my dad, a salesman, and another to my girlfriend, a patent attorney.”



PROMETHEANS IN THE LAB
CHEMISTRY AND THE MAKING OF THE MODERN WORLD
by Sharon Bertsch McGrayne
McGraw-Hill, 2001; 243 pages

Sharon Bertsch McGrayne tells the stories here of nine chemists whose discoveries changed the way we live our lives—the mundane things, like soap, dyes, sweets, nylon, and refrigerators, that are the conveniences of modern life. But this isn’t just “Better Living Through Chemistry”; she also describes the dark side of the chemical revolution, the cost of some of those conveniences to the environment and human health. And intertwined with the chemistry and with the author’s even-handed cost-benefit analysis, are colorful and entertaining accounts of the lives of some very human scientists.

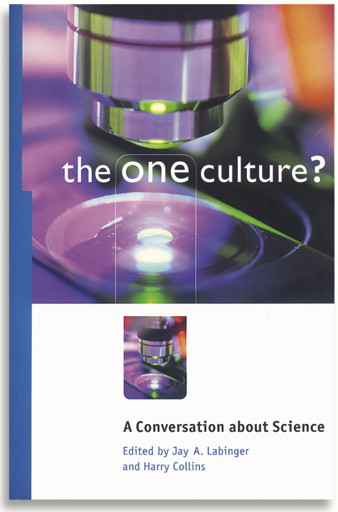
Take Thomas Midgley Jr., who was single-handedly responsible for two of the late 20th century’s most dangerous pollutants. Midgley found a safe and efficient refrigerant in chlorofluorocarbons, which led to ubiquitous air conditioning and, later, the ozone hole. He also discovered in the 1930s that adding tetraethyl lead to gasoline made automobile engines run more smoothly, without knocking. No matter that 15 workers in tetraethyl lead factories died of lead poisoning; Midgley publicly poured some over his hands to prove it safe.

In her last chapter, McGrayne gets to the hero of her collection of stories, the man who dedicated much of his scientific career to negating Midgley’s contribution to civilization: Clair Patterson, a member of the Caltech faculty for more than 40 years. Patterson, a geochemist, determined the age of the Earth at 4.5 billion years by analyzing tiny amounts of lead isotopes. In the process, he learned that everyday life on Earth was far more contaminated with lead, a neurotoxin, than anyone had realized—or was willing to admit.

“Over the next 30 years, Patterson used mass spectroscopy and clean laboratory techniques to demonstrate the pervasiveness of lead pollution,” McGrayne writes. “He traced the relationships between America’s gas pump and its tuna sandwiches, between Roman slaves and silver dimes, and between Native American Indians and polar snows. He forged as close a connection between science and public policy as any physical scientist outside of medical research. He made the study of global pollution a quantitative science. And marrying his stubborn determination to his passionate conviction that science ought to serve society, Patterson never budged an inch.”

Patterson’s social conscience, says McGrayne, arose out of penance for his war work at Oak Ridge separating uranium isotopes for the Manhattan Project. But facing down powerful industrial interests fitted him well; it fed his natural cantankerousness and iconoclastic spirit, which the author captures as she traces his lonely campaign to rid the world of lead pollution. Often derided as a fanatic, he was directly responsible for passage of the Clean Air Act of 1970; the automobile industry responded with catalytic converters, which are inactivated by lead, and leaded gasoline became a thing of the past. By 1980 the average lead level in American blood had dropped 40 percent, and in the ’90s to just a third of that. The amount of lead fallout onto Greenland’s ice cap had declined 90 percent by 1989.

Patterson was frequently nominated for the Nobel



Peace Prize (by Saul Bellow, who featured a Patterson-like character in his novel *The Dean's December*). He died from an asthma attack in 1995, a disease first contracted collecting gas samples from a Hawaiian volcano a dozen years earlier. —*JD*

1980: Clair Patterson exhibits lead-soldered tuna cans, which he fought to remove from grocery

THE ONE CULTURE? A CONVERSATION ABOUT SCIENCE

Edited by Jay A. Labinger and Harry Collins
The University of Chicago Press, 2001; 329 pages

Language authority H. W. Fowler wrote that English speakers who neither know nor care what a split infinitive is "are the vast majority, and are a happy folk, to be envied" by those who do know and care. The same might be said of scientists and their awareness of the so-called science wars. According to Jay Labinger, coeditor with Harry Collins of *The One Culture? A Conversation About Science*, "very few scientists are interested, let alone involved," in a debate that has its roots in Thomas Kuhn's publication of *The Structure of Scientific Revolutions* in 1962, and that broke into the open in 1996 when physicist Alan Sokal published his hoax—purporting to be a critique of science—in the "cultural studies" journal *Social Text*. The majority of scientists, apparently, are not even aware that a war is on.

In an effort to generate some light from the heat and fog of war, Labinger, administrator of Caltech's Beckman Institute, and Harry Collins, a British sociologist, have brought together representatives from both sides. The editors admit their focus is narrow: "We concentrate primarily on issues that have arisen out of the field called 'sociology of scientific knowledge' (SSK) and the critical responses thereto." No proponents of literary theory or cultural studies are represented, and all but one of the active contributing scientists are physicists.

The result is an excellent book whose intended audience is unclear. The editors' goals of seeking "a little convergence" between the two sides, of reintroducing complexity into the debate, and of at least clarifying some of the unresolved differences, will certainly resonate with those familiar with the issues, but may have little meaning for those who are not. This is unfortunate, since the matters being discussed are important.

Why important? The ultimate issue under debate is that of who speaks for science. Is it practicing scientists themselves, or the "SSKers," who study science by utilizing a relativism that "brackets out" any notion of science discovering facts about the real world (as opposed to socially constructing them), or postmodernists for whom science is "just another story," or some combination of these? Where do people who are not scientists or sociologists or literary theorists fit in?

Contributors—particularly on the SSK side, though to a certain extent on both sides—claim that their debate over the nature of science has had little impact on the world at large, whether in terms of affecting science funding or the way the public perceives science. Perhaps so, but reading these essays I wonder whether that could change. Several of the SSK contributors seem to believe that showing science to be socially constructed will increase public understanding of science and aid policymakers in dealing with issues involving science. As neither a scientist nor a sociologist, I have my doubts. When it comes to issues like global warming or genetically modified foods or mad-cow disease, I want to feel that scientists are working to discover what is really going on. That reaching a scientific consensus is a social process goes without saying. The question is whether that process is genuinely—if provisionally—finding out things about the natural world in a way that other processes don't.

SSK, as presented here, reminds me more than anything else of classical behaviorism, which "bracketed out" phenomena such as emotion, instinct, and mind. Behaviorism produced some interesting work, but in the end proved to be a dead end. Contributor Trevor Pinch writes of so-called science studies: "Rather than treating science as the 'exotic other' or just as a different animal, it levels the playing field—all animals are really the same, and they are not all that exotic." Perhaps. But while studying, say, human-kind as just another animal may be necessary, it is surely not sufficient for understanding what is essentially human. Similarly, bracketing out the scientific "facts of the matter" may keep science studies from ever finding out all that much about science. (It is ironic that, after repeated SSK assertions that science has no unique essence, Harry Collins refers us to "the kind of assiduous study done in the field or in laboratories," to distinguish science from, for example, creationism. Collins, I'm sure, didn't intend trying to define science, but what he says does bring to mind the definition G. G. Simpson offered nearly half a century ago: "Science is an exploration of the material universe that seeks natural, orderly relationships among observed phenomena and that is self-testing.")

I've said little about the contributions by Labinger, Sokal, and the other scientists, mainly because their essays are so clearly thought out and written. Reading the book is a bit like riding a boat on a choppy sea: a rise into clarity followed by a plunge into obscurity. Not uniformly, of course. Interestingly, the scientists most opposed to the methodology of SSK seemed the clearest; the scientists with some sympathy for SSK somewhat less so; and the majority of SSKers and allies less so yet, with Peter Dear's offering re "epistemography" particularly difficult going, encompassing a turgidity and hairsplitting worthy of a medieval theologian.

The book is well indexed, and the editors have usefully provided bracketed numbers when important topics are introduced, referring the reader to other chapters where the same topics are discussed by other contributors with differing viewpoints.

I hope *The One Culture?* finds an audience, especially among scientists, who—as this book makes clear—are being studied by a group that claims for itself an objectivity it would deny to those it studies. I think the public at large could find it interesting, perhaps even helpful, as well. I did. —*MF*

The 16th annual meeting of the Society for Literature and Science, which seeks to strengthen bridges between the two fields, will be held October 10–13, 2002, in Pasadena, with support from Caltech and the Huntington Library. Proposals for panels and papers are due June 1. For more information, see the conference Web site at http://SLS-2002.caltech.edu/ or contact Jay Labinger, jal@its.caltech.edu. □

Lyman G. Bonner
1912 – 2002

Lyman Bonner, who served Caltech in a number of administrative positions between 1965 and 1989, died in Pasadena on March 22 at the age of 89.

Bonner was born in Kingston, Ontario, on September 16, 1912, the second of seven children. His first encounter with Caltech came in 1929 as a 17-year-old transfer sophomore, while his father, head of the chemistry department at the University of Utah, was on sabbatical here. Bonner finished his degree at Utah in 1932 and followed his older brother James back to Caltech as a graduate student. He earned his PhD in chemistry in 1935, the second of four Bonner brothers to hold Caltech doctorates.

His dissertation work on molecular structure led to an interest in infrared spectroscopy, which at Princeton, where he went next as a National Research Council fellow, had its home in the physics department. It was there that, as Bonner says in his 1989 oral history, "I decided I enjoyed physics and physicists more than I enjoyed chemistry and chemists, and I quietly made a switch." In 1937, he became an instructor and then assistant professor of physics at Duke, where he taught young naval officers in the wartime V-12 program.

When that program began to phase down in 1944, Bon-