

Summer Reading

Ah, summer approaches! Perhaps you will find some time for leisure reading. With this hope in mind, here are a few suggestions that Jeff Kovac, our Book & Media Reviews Editor, has assembled with the help of Dick Pagni, Hal Harris, and Brian Coppola.

Dick Pagni recommends

The Limits of Science by Peter Medawar

Oxford University Press: Oxford, 1986. 108 pp.
ISBN 0192830481. Out of print.

Beyond Science: The Wider Human Context

by John Polkinghorne

Cambridge University Press: Cambridge, 1996. 131 pp.
ISBN 0521625084. \$14.95.

On Science by B. K. Ridley

Routledge: New York, 2001. 225 pp. ISBN 0415249805.
\$50.

I can think of no better way of discovering what science is and is not and what it can and cannot do than by reading these three quite different books. All were written by mature British scientists with keen interests in the philosophy and history of science who have thought deeply on these issues.

Science—and its practice—consists of many things but at its core contains several interrelated activities: observing, experimenting, deducing, and theorizing. Where do these approaches apply? What limits do they have? There is one extreme (and in my opinion, false) view, as exemplified in the messianic, reductionist vision of E. O. Wilson's *Consilience*, that nothing lies beyond the power of science to explain. Given enough time, even all aspects of human behavior and action will be understood. Given enough time, "the theory of everything" will be discovered. There is also an extreme anti-science view, as expressed by many contemporary sociologists of science, that science is only culturally derived and that one culture's vision of the world is no better or more valid than another's. As I do, the three authors of the recommended books refute this. If science were derived only from the West, where most of its activity has occurred, and its culture, why is it so successful?

The authors of the three books in question present a more reasoned and measured view on the nature of science and its successes and limitations. Even though they are unable to explain why science works, they all agree that it provides a true, objective, but limited picture of the world. Science can describe the attributes of things such as elementary particles, but not their essences. Does anybody really know, for example, what electric charge is? Science is not, nor will ever be, able to explain first and last things. Where did the universe come from? What happens when we die? Science is poorly equipped to deal with the moral and ethical dimen-

sion. As science deals with reproducible phenomena, it also cannot handle unique things such as the universe itself, the individual, and artistic expression.

The three books are eloquent each in its own way. Medawar, a biologist, whose *The Limits of Science* is alas out of print and likely available only in university libraries, is a defender of science, scientists, and the scientific method. He ranges far and wide in this very short book, discussing such issues as anti-science, the unintelligibility of science to lay people, politics and science, the destruction of the environment—areas where science can say little (i.e., the limits of science)—and his own a-theistic outlook. What holds all of this together is Medawar's lively, lucid, and often witty prose.

Polkinghorne, a former theoretical physicist and current head of Queen's College at Cambridge University, also ranges far and wide in his exquisitely written *Beyond Science: The Wider Human Context*. He offers an insightful discussion of what science is and what scientists do, and all in a few pages. He gives several delightful portraits of great physicists that he has known in his career, such as Dirac and Salam. Being also an Anglican priest, he is especially interested in the moral and ethical dimension, the issues beyond science. He has much to say here and eloquently addresses such things as value, the environment, exploitation, the human mind, ultimate questions, and more.

Ridley, also a physicist, has written the most expansive of the three books. *On Science* covers some of the same ground as the other two books do, but has distinctive features too. There are nice discussions of the ever fascinating relationship between science and mathematics and the mind-body problem, perhaps the most vexing and perplexing in all of science and philosophy. I think it fair to say that the author does not have a reductionist point of view here. He describes the peculiar world of the quantum at length. Of particular note is the current inability of science to describe the boundary between the quantum and classical worlds. I particularly enjoyed Ridley's discussion of science's inability to deal with unique phenomena.

The three authors confront a wide range of thorny issues, and it is not likely that you will agree with their points of view on every one, or perhaps on any of them. Nonetheless, if you want to read good writing, if you want to be stimulated and provoked, and if you want to become more aware of the pressing issues facing science, scientists, and the scientific method, read these three books.

Summer Reading

Dick Pagni recommends

Instruments and the Imagination by Thomas L. Hankins and Robert J. Silverman

Princeton University Press: Princeton, NJ, 1995. 337 pp.
ISBN 0691029970. \$21.95.

Instruments play a pivotal role in the modern scientific enterprise. They do what our senses cannot do or do poorly. A hallmark in the development of science in the 17th and 18th centuries was the use of instruments to help scientists understand how the universe is put together. Telescopes helped them see further and microscopes smaller; clocks helped them measure time more accurately. Some instruments existed long before the advent of the scientific age but were used primarily to display astonishing effects (natural magic) and not for science (natural philosophy). Some of these made the transition to science, often taking a considerable period of time to do so. Some never lost their natural magic status.

During the heady times in which the scientific method evolved, it was not always clear if a given instrument was scientific or magical. Many practitioners made little distinction between the two. It was not even clear if an instrument had to be built to be useful. Merely thinking about how the device might work and what it might discover was enough. This attitude in some sense is similar to Einstein's in his "gedanken" experiments.

How all this came about is the story described beautifully in *Instruments and the Imagination*. It is a scholarly yet very readable book on the development and use of magical scientific instruments over a period of two or three centuries. As science is a human activity, this is also the story of an amazing group of interesting, often oddball, characters. Some we rarely think of in scientific terms. Jean Paul Marat, the French physician and politician of the French Revolution, perhaps best known from Jacques-Louis David's death portrait, makes an appearance, for example. The instruments

themselves are ever-fascinating and often bizarre. There is the magic lantern (the precursor to the slide and overhead projectors), the quite unbelievable cat piano, the ocular harp that produced color and not sound and was never built, the sunflower clock, the aeolian harp, and precursors to recorders, cameras, and phonographs.

I highly recommend this book. It contains first-rate scholarship, is fun to read, and shows what a wondrous and peculiar thing the human race is.

The Scientific Revolution by Steven Shapin

University of Chicago Press: Chicago, 1996. 218 pp.
ISBN 0226750205. \$19.95.

I believe that most scientists would agree that the Scientific Revolution was a transforming event in the same sense that the French Revolution was. Until recently, historians of science would have concurred. They saw a confluence of ideas and practices of many 17th century Europeans including Galileo, Newton, Descartes, Leibnitz, and Bacon, which created the modern scientific method. It is as if this process had no antecedents. To some, the Revolution also took on a romantic and heroic quality, and one of inevitability, when the trials and travails of some of the well-known cast of characters were considered. These views are no longer current in some quarters, however. Steven Shapin, a sociologist, thinks that things were much more complicated and that nothing was inevitable or written in stone. Much of what occurred in the 17th century did have important antecedents and there were many missteps on the road to the scientific method. If you are interested in learning more about this fascinating period or seeing it from a refreshing historical and cultural perspective, you should read this short and entertaining book.

Summer Reading

Hal Harris recommends

Nine Crazy Ideas in Science: A Few of Them Might Even Be True by Robert Ehrlich

Princeton University Press: Princeton, NJ, 2001. 244 pp.
ISBN 0691070016. \$24.95.

One of the goals of a course I teach in our Honors College is to provide non-science majors with the tools they need to differentiate authentic science from material that has merely been provided a "scientific" dressing. Physicist Robert Ehrlich has provided nine case studies that are ideal for this purpose. Do more guns in the hands of citizens decrease crime? Is AIDS really caused by HIV? Is sun exposure harmful or beneficial? Are low doses of (nuclear) radiation beneficial? Does our solar system have two suns? Do "fossil" fuels really come from abiogenic origins? Is time travel possible? Is the Big Bang a myth? Are there faster-than-light particles? Ehrlich takes a serious and analytical look at each of these questions, and (unfortunately, I think) states his answer at the end of each chapter. The important thing is, of course, not the conclusion but the quest for it.

Brunelleschi's Dome: How a Renaissance Genius Reinvented Architecture by Ross King

Walker: New York, 2000. 194 pp. ISBN 0802713661. \$24.

Brunelleschi's Dome is an excellent example of technology in a historical context. The author, Ross King, focuses on one of the great achievements of medieval technology, the construction of the dome of the cathedral Santa Maria del Fiore in Florence, Italy. The man whose design won the competition for the construction of the monument that still defines the city was a goldsmith and clockmaker named Filippo Brunelleschi. Brunelleschi not only proposed to build this huge and high dome without the support of an internal "centering" structure, but also invented numerous devices to hoist

materials to the construction locus and to reinforce the structure without the "flying buttresses" that characterized other structures of the time. King does an outstanding job of putting the architect in the context of his time.

Readers interested in reading more about the technology of the Renaissance may wish to look up *Brunelleschi: Studies of His Technology and Inventions* (MIT Press, 1970) and *Mariano Toccolia and His Book De Ingeneis* (MIT Press, 1972). Both books are by Frank D. Prager and Gustina Scaglia.

The Lying Stones of Marrakech: Penultimate Reflections in Natural History by Stephen Jay Gould

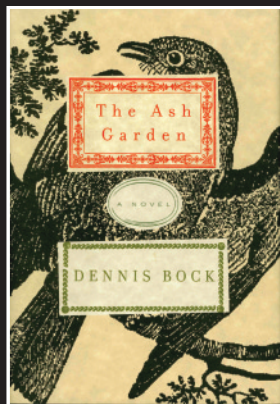
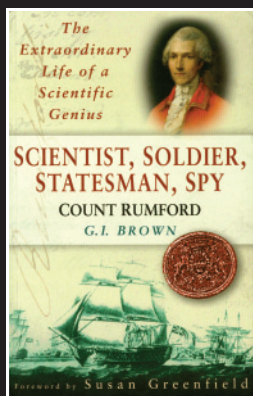
Harmony: New York, 2000. 371 pp. ISBN 0609807552. \$15.

I find it surprising that this is the first book by Stephen Jay Gould to have been selected as a "Hal's Pick", since I own and have enjoyed reading many of them. I have had the pleasure several times of meeting Gould speak and hearing him speak, and I wish I could write as well as he speaks extemporaneously. *The Lying Stones of Marrakech* is a collection of recent columns from Gould's feature in *Natural History*; the title essay is about the fake fossils from Morocco that are flooding the market in the United States. As a paleontologist, Gould has a strong interest in fossils, and he takes the opportunity to discuss other important fossil deceptions that have occurred in the past. Of particular interest to chemists (at least to this one) was "The Proof of Lavoisier's Plates", describing the contributions of the famous founding father of our science to the early history of geology.

Waiting for Aphrodite: Journeys into the Time before Bones by Sue Hubbell

Houghton Mifflin: Boston, 1999. 242 pp. ISBN 061805684X. \$13.

Sue Hubbell has written beautifully about her experiences as a beekeeper in rural Missouri. For example, I recommend her *Broadsides from the Other Orders* and *A Country Year*. Recently, she moved to the coast of Maine and this book describes her wonder at the new creatures she finds on the coast, comparing and contrasting them to the ones with which she had been familiar. In all cases, she sticks to invertebrates. I found the book to be particularly interesting because the animals she describes are ones that nearly all of us have seen: earthworms, "pillbugs", crickets, millipedes, sea urchins, sponges, horseshoe crabs, fireflies, and bees. However, she interleaves these with animals with which fewer of us have experience: sponges, sea cucumbers, nudibranchs, and the elusive *Aphrodite aculeata*, the "sea mouse". In addition to her observations in Missouri and Maine, she takes us with her to a rain forest in Belize and a tropical island in the Caribbean, and she does a fine job of showing that an understanding of evolution is necessary for all of this to make sense.



Vacuum Bazoorkas, Electric Rainbow Jelly, and 27 Other Saturday Science Projects

by Neil A. Downie

Princeton University Press: Princeton, NJ, 2001. 256 pp. ISBN 0691009861. \$18.95.

If, like me, you are still mourning the demise of the great old *Scientific American* column "The Amateur Scientist", you will probably enjoy this collection of tested projects. Downie's obvious enthusiasm and humorous writing style almost demand that you get out into the garage and try them. Better yet, find a budding scientist or engineer to work with you. I especially like the fact that the science and mathematics behind the construction are fully and accurately described. Only one of the projects is really chemistry: "Electric Rainbow Jelly" is made by electrolyzing a gel containing universal indicator.

Backyard Ballistics

by William Gurstelle

Chicago Review Press: Chicago, 2001. 274 pp. ISBN 1556523750. \$16.95.

Despite the first chapter, "Keeping Safety in Mind", I would not put this book in the "politically correct" section of the library. Many of the projects described in *Backyard Ballistics* have intrinsic hazards, and kids who are old enough to build a potato cannon, a match rocket, or a carbide cannon, for example, may not be mature enough to use them without hurting themselves or damaging property. So why do I recommend this book? Because when a knowledgeable adult supervises these projects, they can be fun and thrilling.

Off the Planet: Surviving Five Perilous Months Aboard the Space Station *Mir*

by Jerry Linenger

McGraw-Hill: New York, 2000. 258 pp. ISBN 007137230X. \$14.95.

The word "surviving" should probably be underlined in the title of this firsthand account by an American astro/cosmonaut of his experiences aboard *Mir*. There is precious little science in this book, but a great deal about living at the mercy of technology and Russian bureaucracy. Even though the reader knows that the author does ultimately survive, suspense nevertheless builds up during Jerry Linenger's telling of his story. One cannot help but wonder at the sanity (or the naiveté) of the several Americans who succeeded him on *Mir*. His description of the adaptation to life without gravity should give considerable pause to those anxious to send people to Mars.

Hidden Evidence: 40 True Crimes and How Forensic Science Helped Solve Them

by David Owen

Firefly Books: Willowdale, ON, 2000. 240 pp. ISBN 1552094839. \$24.95.

Even readers who already know something about forensic science are likely to learn from *Hidden Evidence* about historic cases that have been solved by science. Unfortunately, there are so few details provided in the book that the most interesting questions often remain unanswered. The book is full of pictures (I suspect that the illustrations were chosen before any narrative was written), and no references are provided. It might be of use to a student inspired by the TV program *Crime Scene Investigators* to consider a career in forensic chemistry.

Summer Reading

Brian Coppola recommends

Salt: Grain of Life by Pierre Laszlo
translated by Mary Beth Mader

Columbia University Press: New York, 2001. 256 pp.
ISBN 0231121989. \$35.50.

Salt: A World History by Mark Kurlansky

Walker: New York, 2002. 352 pp. ISBN 0802713734. \$34.95.

Old salt, new shakers. For years, popular books about chemistry have been as rare as naturally occurring technetium. But the tide is turning, and while chemistry may not yet have its Stephen Jay Gould, it does have its *Uncle Tungsten*. Who would have guessed that you might have two different books about lowly sodium chloride competing for your attention? Perhaps it is true after all: when it rains, it pours.

Each of these two books has its own strengths stemming from the different perspectives and experiences brought by their authors. Pierre Laszlo (*Salt: Grain of Life*) is an emeritus professor of chemistry at the University of Liège, Belgium, and the École Polytechnique near Paris, France. He has a scholarly publication list that is as deep as it is versatile. Mark Kurlansky (*Salt: A World History*), a New York food writer who a few years ago explored the impact of salt cod on civilization (*Cod: The Biography of the Fish That Changed the World*), has now focused on the substance that made codfish famous.

Laszlo is the Renaissance writer. He is a philosopher, a historian, a chemist, a biologist, and a linguist. He is inclined to include the spectroscopic characteristics of a compound alongside a relevant anecdote, each (amazingly) reinforcing the other. Kurlansky's book is aptly titled. He means to anchor, almost evangelically, salt's significance to the history of the world. His book reads like an epic, whereas Laszlo's is a series of interesting (and "impish", using the word of one reviewer) short stories hung together by a theme.

Both authors cover the essentials. Vikings seek out salt and begin its trade; the first great Roman road is the Via Salaria or Salt Road. The word "salary" originated with the Latin word for salt because this rare substance served as a remuneration for soldiers. Whether in Spain, the Americas, or in Ghandi's India, the connection to the world's most edible rock can be uncovered. Laszlo is self-indulgent and digressive in the way he, a bit like Burke in his "Connections" series, meanders along multicultural tendrils without worrying too much about anything except the pleasure of the journey. Kurlansky is trying to create the book he might imagine a professor might write. Don't get me wrong, there is plenty of entertainment; it is just that he does not possess

the kind of background knowledge to bring any chemical insight into the story of salt that a chemistry professor like Laszlo does.

If you can take this much salt in your diet, get both books and read Laszlo first. You can then frame your reading of Kurlansky to get details in areas that interest you. Both books are great resources for those offhanded comments that well-seasoned faculty enjoy sharing with their classes.

Honored but Invisible: An Inside Look at Teaching in Community Colleges by W. Norton Grubb

Routledge: New York, 1999. 416 pp. Cloth: ISBN 0415921643. \$75. Paper: ISBN 0415921651. \$24.99.

The fifty-percent solution. I attended a meeting a few months ago where the vice president of a large community college system who presumed our prejudice about these schools and then immediately got our collective attention, spoke. He opened his remarks with the following statement: "When you call 911, the people who respond have most likely been educated at a community college." The facts are clear: about 50% of all students begin their college experience in this setting, and about 50% of faculty positions are located there. Yet the degree of understanding and attention given to this facet of higher education, especially by those in the "higher" higher education, is limited.

W. Norton Grubb (professor and David Gardner Chair in Higher Education at the University of California, Berkeley) has built this book on observations of and interviews with more than 300 faculty and administrators in community colleges. It concludes that the quality and understanding of teaching and learning is severely limited, especially in the way we neglect appropriate professional development for those who take faculty positions. The range of practice is broad, spanning remarkable examples of progressive pedagogy to dead and disengaged didactic teaching.

Although its audience is more likely to be administrators and policy makers, this book contains important ideas for all faculty to think about. Grubb is not particularly prescriptive in his solutions, but he does think that the simple lack of real articulation between the different facets of higher education represents a rational target with a high payoff. The connection is natural, because all faculty have received their Ph.D.'s at the 6% or so of institutions that are most unlike community colleges. If every graduate student who subsequently joined the instructional ranks at community colleges could read and reflect on a book like this, it might provide a useful departure point for conversations in multiple settings about the professional needs and demands associated with these settings.

Summer Reading

Brian Coppola recommends

Free Movies

<http://www.ifilm.com>;
<http://www.hypnotic.com>

What would my summer reading recommendations be without a nod to the Internet? This year, I am going to plug two sites that draw on an impressive array of products from independent filmmakers. You need to be on a high-speed line, which might limit your ability to catch these beauties while you are vacationing, but there are some wonderful 8- to 15-minute shorts that are well worth the price of admission (especially since there is no cost!). These two sites are extremely well indexed, draw an array of high quality films, and do all the amazon.com-like goodies such as cross-referencing your selection to similarly themed movies and providing reviews and ratings. So upgrade your movie player plug-ins and cruise over to these sites whenever you get a taste for a dollop of humor or a dab of haute couture.

Summer Reading

Jeff Kovac recommends

**Scientist, Soldier, Statesman, Spy:
Count Rumford, The Extraordinary Life
of a Scientific Genius** by G. I. Brown

Sutton: Stroud, UK, 1999. 192 pp. ISBN 0750926740. \$12.95.

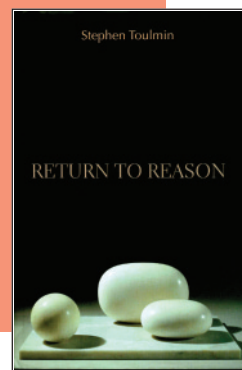
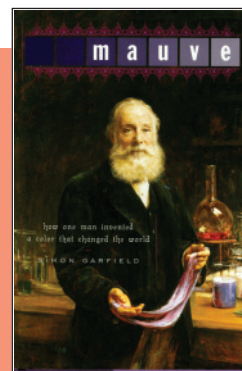
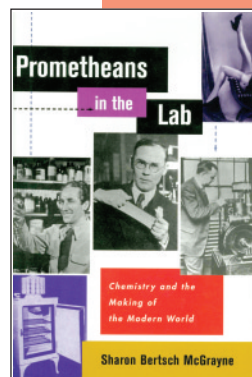
It is hard to imagine an adventure novelist inventing a character as fascinating as Count Rumford, born Benjamin Thompson in 1753 in Woburn, Massachusetts. As the title of this short, lively biography by G. I. Brown indicates, Rumford was a multit talented man; Franklin Delano Roosevelt put him in the same category as Jefferson and Franklin. As a scientist he studied the fundamental nature of heat; as an inventor he developed a more efficient stove and designed coffee pots. He applied scientific methods to improving living standards for the poor. He played a major role in establishing the Royal Institution in London, where both Humphry Davy and Michael Faraday did their best work. Yet because of his acerbic personality and scandalous lifestyle, he was vilified by many of his contemporaries and died almost alone. Brown gives us a balanced picture of this brilliant and complex man.

**Prometheans in the Lab: Chemistry and the
Making of the Modern World** by Sharon Bertsch
McGrayneMcGraw-Hill: New York, 2001. 224 pp. ISBN 0071350071.
\$24.95.

Chemistry is the most useful of sciences. Chemists owe as much to the craft tradition as they do to natural philosophy. This engaging new book by Sharon Bertsch McGrayne is a balanced approach to the complex relationship between chemistry and society. McGrayne tells the stories of nine scientists, primarily chemists, whose work has significantly affected society. She begins with Nicolas Leblanc, developer of one of the first industrial chemical processes, and ends with Clair C. Patterson, whose studies of lead in the environment resulted in the elimination of leaded gasoline. Along the way we meet such well-known figures as William Henry Perkin, Fritz Haber, and Wallace Hume Carothers, and some lesser known figures including the fascinating Norbert Rillieux, who invented an efficient process to refine sugar.

Not only does McGrayne provide fine biographies of the people who made the discoveries, she also does an excellent job of explaining the technical details to the nonspecialist. I found the scientific explanations to be, on the whole, quite accurate. She describes the enormous benefits of the various discoveries, but also the costs—particularly the environmental pollution that resulted from the growth of the chemical industry. The book is quite evenhanded. While McGrayne clearly is sympathetic to the environmental movement, she also recognizes the importance of chemical products to modern life.

One of the best chapters concerns Wallace Hume Carothers, the troubled genius who contributed so much to



both fundamental and industrial polymer chemistry before committing suicide at age 41. McGrayne provides some details and insights into Carothers's life and work that can be found nowhere else. The rise and fall of leaded gasoline is told in two chapters, one on Thomas Midgely, who discovered that tetraethyl lead was an effective antiknock agent, and another on Clair C. Patterson, whose careful experiments and passionate advocacy convinced the world of the dangers of lead pollution. Finally, I was delighted to read about Edward Frankland, one of the forgotten discoverers of the theory of valency, who was one of the first advocates for the importance of clean drinking water.

This is a book that all of us who teach chemistry should read and recommend to our students.

Mauve by Simon Garfield

Norton: New York, 2001. 224 pp. ISBN 0393020053. \$23.95.

Before William Henry Perkin, the world was rather dull. Almost all clothing was either undyed or dyed with the muted colors obtained from natural sources. Interesting and bright colors were expensive; only the rich could afford them. Perkin

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synthesized the first coal-tar dye, the famous mauve, and developed an industrial process to manufacture it; thus he spawned the massive dye industry, which was eventually dominated by Germany. Not only does Garfield tell Perkin's story, he also examines the dye industry in general and the role of dyes and color in society.

The Ash Garden by Dennis Bock

Knopf: New York, 2001. 281 pp. ISBN 0375413022. \$23.

The shadow of Hiroshima still haunts us. Even after more than 50 years, the moral and human questions that appeared in a blinding flash that August morning remain unanswered, and probably unanswerable. But one of the best ways to confront such difficult questions is through stories, and this powerful new novel by Dennis Bock is an imaginative exploration of the deep human issues raised by the war and the dropping of the bomb. It tells the interlocking stories of three people: a scientist and his wife, both refugees from the war in Europe, and one of the "Hiroshima maidens" who survived the bomb and were brought to the U.S. for reconstructive surgery. It is a novel I will read again and again.

Return to Reason by Stephen Toulmin

Harvard University Press: Cambridge, MA, 2001. 243 pp. ISBN 0674004957. \$24.95.

Stephen Toulmin is a remarkable scholar. A student of both Dirac and Wittgenstein, his work encompasses the history and philosophy of science, ethics, rhetoric, and intellectual history. His latest book, *Return to Reason*, is in many ways a summation of his life's work. It champions the virtues of practical reasoning, common sense if you will, contrasting it with theoretical reasoning. Written for a general audience, this volume is a delightful and provocative introduction to Toulmin's thinking. It will change the way you look at rationality.

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