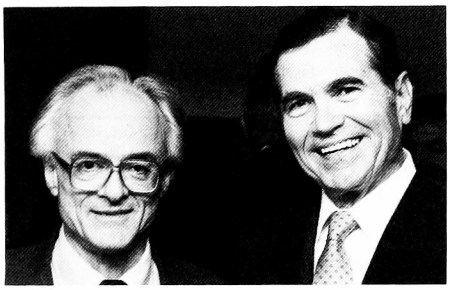
ΦBK The Key Reporter

VOLUME 50 □ NUMBER TWO □ WINTER 1984–85

BOOKS ON SWIFT, ASTRONOMY, AND JEWISH LITERATURE WIN AWARDS FOR 1984

The 1984 Phi Beta Kappa book awards for outstanding contributions to humanistic learning were awarded at the annual Senate dinner in Washington, D.C., December 7. Irvin Ehrenpreis, Linden Kent Memorial Professor of English Literature at the University of Virginia, won the Christian Gauss Award for *Swift: The Man, His Works, and the Age,* Vol. III, published by Harvard University Press. George Greenstein, professor of astronomy at Amherst College and chairman of the Five-College Astronomy Department, won the Science Award for *Frozen Star: Of Pulsars, Black Holes, and the Fate of Stars,* published by Freundlich Books, New York. And David G. Roskies won the Ralph Waldo Emerson Award for *Against the Apocalypse: Responses to Catastrophe in Modern Jewish Literature,* also published by Harvard. Each award carries a $2,500 prize.



Irvin Ehrenpreis (left) and Gauss committee chairman Carl Woodring.

In presenting the prize for literature, Gauss committee chairman Carl Woodring praised Ehrenpreis's account of the private, public, and literary life of Jonathan Swift as a "monument to sanity." He said that the author, "standing tall on the shoulders of the best critics and scholars from Swift's day to ours, draws as well on his own searches through manuscripts and newspaper accounts previously neglected and on his own strong and sound intelligence." He added, "Every detail directly serves the reader's comprehension of Swift's intellect, sensibility, and actions." [See excerpt on back cover.]

In presenting the award for science writing to Greenstein, committee chairman Herschel Roman commended Greenstein for capturing the "confused, unplanned, marvelous, and fascinating process by which real scientists make real discoveries." He added, "What we have here is a dynamic, forceful, and extremely engaging piece of literature. Seldom have I seen a work that conveys so clearly what scientists do—and how they do it." He also praised Greenstein's "fearlessness in exposing the uncertainty that absolutely permeates the scientific endeavor."

In describing *Against the Apocalypse,* Emerson committee chairman Merrill D. Peterson said, "There are some books that grasp the reader with the first sentence and never let go." [See excerpt on back cover.] Roskies writes "with a power at once scholarly and poetic," Peterson said, of the collective memory of catastrophe—from the First Destruction of the Temple through the Holocaust—that has enabled the Jewish people to triumph over destruction and despair. The book, Peterson added, is "a work of deep learning, literary sensibility, and critical judgment" that "rises above mere scholarship."

George Greenstein (left) and Science Award committee chairman Herschel Roman.

Roskies was unable to attend the ceremony, but Maud Wilcox, editor in chief at Harvard University Press and principal editor for Roskies's book, accepted the award in his behalf.

The 1985 Phi Beta Kappa book awards are open to qualified books published between June 1, 1984, and May 31, 1985. Entries must be submitted, preferably by the publishers, by May 31, 1985. Inquiries and entries should be addressed to the appropriate award committee at 1811 Q Street, N.W., Washington, DC 20009.

Nobel Laureate Will Lecture at AAAS Meeting in Los Angeles

William A. Fowler, a Nobel Prize winner and professor of physics emeritus at the California Institute of Technology, will deliver the annual Phi Beta Kappa Public Lecture at the spring meeting of the American Association for the Advancement of Science. The lecture is scheduled for 1:30 p.m. on May 29 in the Pacific Ballroom of the Los Angeles Hilton Hotel, and all Phi Beta Kappa members in the area will receive invitations to attend.

Application Forms for New Chapters Available

Application forms for Phi Beta Kappa faculty groups wishing to establish new chapters may now be obtained from the United Chapters. Also available is a leaflet describing procedures for the founding of new chapters.

The Phi Beta Kappa members of the faculty at a college or university seeking a chapter should organize informally and choose a representative to conduct the correspondence with the United Chapters. The Phi Beta Kappa faculty group is expected to be at least ten in number or 10 percent of the full-time teaching faculty, in order to provide an adequate nucleus for organizing a new chapter and efficiently conducting its activities.

Applications for the next triennium, which will be voted on at the Council meeting in the autumn of 1988, are due November 1, 1985. Please address all inquiries to the Secretary of the United Chapters of Phi Beta Kappa, 1811 Q Street, N.W., Washington, DC 20009.

Maud Wilcox, editor in chief at Harvard University Press, with Emerson committee chairman Merrill D. Peterson.

Black Holes

NEWTON, EINSTEIN, AND SCHWARZSCHILD

by George Greenstein

A black hole is a pathology of gravitation, a singularity in an object's gravitational field. As for the nature of this object, it could be anything—a star, a planet. The object is not important. It is the singularity that counts. This singularity wraps around the object that made it and renders it wholly invisible. It bends the paths of light rays. It distorts the image of the distant sky. It distorts the very fabric of time and space. And finally, it reacts back upon the object and crushes it out of existence. This destruction is hidden behind a veil. Before our very eyes a solemn event is being enacted —the drama of the ultimate fate of matter. We never see it.

It is easier to say what a black hole is not than what it is. It is not a hole. "Holes in space" is a phrase occasionally used, even by scientists who should know better, to describe them. But it is not a good description. More than that—it is meaningless. A hole is a place where there is no matter; space is a collection of places where there is no matter. The phrase has no more sense to it than "spaces in space" would.

Actually the term has quite a different meaning. It is slang. In England a black hole is a *jail,* as in the black hole of Calcutta. In this sense it is good enough: the black hole is a prison in which matter is entombed forever.

In approaching so strange and forbidding a subject, it is best to start with an imaginary experiment. Bring an immense array of battering rams against the Sun and crush it inward. As the Sun is so compressed, its internal structure alters radically. But although this happens, it is not the point. The point is the force of gravity on its surface.

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The Sun is massive and the force of gravity it exerts is large—much larger than the Earth's. If a 150-pound man were to stand on the surface of the Sun, he would weigh a full two tons there. And if we were then to compress the Sun, his weight would increase still further. As the Sun is compressed the very same quantity of matter is being packed into a smaller and smaller region of space, and the force of gravity it exerts grows stronger. The smaller the Sun becomes, the more that 150-pound man standing on its surface weighs.

Also important is the *velocity of escape* from the Sun. This is the velocity that must be imparted to an object in order to send it flying away into space. Escape velocity from the Earth is 7 miles per second. Throw a stone any slower and it falls back to Earth. Throw it at any greater velocity—by firing it off in a rocket, for example—and the stone is launched to the stars.

Escape velocity from the Sun is a good deal greater, of course. It works out to about 390 miles per second, and if the Sun is compressed, the escape velocity grows yet larger. If the Sun is shrunk to just half its present size, the weight of the 150-pound man is increased to 8 tons, and the escape velocity increases to 550 miles per second. If the Sun is compressed to one-tenth its present radius, the man weighs a full 200 tons, and the velocity of escape climbs to more than 1,000 miles per second. If the Sun is compressed until it is just the size of the Earth, the enormous concentration of matter attracts the man with a force of 25,000 tons, and the escape velocity is 4,000 miles per second. Still more compression. Crush the Sun down upon itself until it is a mere 1.75 miles in radius. Now gravity has assumed such an unthinkable intensity that the velocity of escape is 186,000 miles per second.

That is the velocity of light.

Einstein's Theory of Relativity

In the year 1905, when he was 26 years old, Albert Einstein received his doctoral degree from the University of Zurich. In the very same year he published three papers in the German journal *Annalen der Physik.* Each one of these papers stands as a major landmark of physics. The first developed a theory of Brownian motion—a theory that provided the final decisive confirmation of the atomic nature of matter. The second developed a theory of the photoelectric effect, and in so doing took a major step forward to the creation of quantum mechanics. And in the third paper Einstein presented the special theory of relativity.

Over the next decade Einstein extended the ideas of special relativity into new domains. The result was the publication, in 1916, of the general theory of relativity. The full theory of relativity was then complete, and to this day it stands as one of the grandest of all the creations of the human race.

It is the mark of a bad theory that it continually requires modification and readjustment in order to accommodate itself to new discoveries as they are made. Theories like relativity are precisely the opposite: the new discoveries conform themselves to it, and they do so in ways that the inventor of the theory could not possibly have foreseen. The theory turns out to be more true than its creator had thought. In 1905 Einstein had predicted that time passes more slowly for an object in motion than for one at rest. When he made this prediction there was not the slightest practical possibility of testing it. It was not until several decades had passed that this possibility arose and Einstein's prediction was confirmed. As it was ultimately performed, the test involved studying the decay of an unstable elementary particle in motion, but in 1905 Einstein had never heard of this particle. Neither he nor any other physicist of his day had the slightest inkling of its existence. In some way his theory had been so profoundly in accord with reality that it jibed with discoveries lying far in the future.

In surveying the progress of science, nothing prepares us for Einstein's achievement. His work was not a logical outgrowth of the methods of his day.

Special relativity had also predicted that the mass of an object when in motion should be greater than when at rest. Today this principle is a truism to the engineers who design giant elementary particle accelerators, but in the year 1905 such accelerators lay generations off. They were inconceivable. Galaxies, too, were inconceivable in those days, but when finally they were found, the vast and majestic expansion of the universe was revealed. It had been predicted by Einstein.

Einstein achieved all this without massive federal funding, without hordes of assistants, without telescopes and computers. He did it by himself, using only the powers of his mind. He did not

This article is excerpted from Frozen Star *(Freundlich Books), which won the 1984 American Institute of Physics–U.S. Steel Foundation Science Writing Award as well as the Phi Beta Kappa Award in Science for 1984. George Greenstein is the author of numerous technical articles on astronomy and astrophysics;* Frozen Star *is his first book.*

rely on the latest data. He did not read all the journals. Instead he retreated into his own solitary thoughts, and he decided how the physical universe ought to behave. Out of pure *a priori* reasoning he constructed his theories and then made them work.

In surveying the progress of science, nothing prepares us for Einstein's achievement. His work was not a logical outgrowth of the methods of his day. Einstein invented new ways of doing physics, and he thought in ways utterly unlike those of his contemporaries. The more his age recedes into the past, the greater he becomes. Even as a young man Einstein was regarded as one of the best physicists of his day, and as he became older he grew in stature. By the time of his death he was held in awe. From our present vantage point he towers over his age as Shakespeare towers over Elizabethan England, or Beethoven over nineteenth-century Vienna. His life's work stands alone, untouched—a major creative act.

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The Nature of Gravity

When discussing black holes, we are talking about gravitation itself. But what is gravity? Gravity is why things stick to the Earth. Right now everything is standing right side up. Six hours from now the Earth will have spun one-quarter of the way about in its daily rotation, and things will all be sideways. The chair, the table, the glass of water on the table: all will lie at a crazy tilt. Water from the dripping faucet will fall horizontally into the sink. In another six hours everything will be completely upside down. Things will fall up. This magic is accomplished by gravitation.

It was Sir Isaac Newton who invented the modern concept of gravity, and to him it was a force. Things will fall because of an attraction between them and the Earth. Our planet exerts a force upon the droplet of water suspended from the dripping faucet: the droplet breaks free and flies toward the Earth. The very Moon itself is not free of this force, and it orbits about us in response.

But the black hole has no place in Newton's scheme of things. It goes beyond Newtonian ideas. The black hole is a child of Einstein's general theory of relativity. General relativity too is a theory of gravitation, but it treats gravity very differently from the way Newton did. To Einstein gravity is not a force at all but a distortion of the very nature of space and time, and its effects are far more subtle than Newton could have realized. It took Einstein 10 years to create this theory, and even today it is one of the most fascinating and complex of all fields of physics.

As with every other physical theory, general relativity's content is summarized in a set of equations—Einstein's gravitational field equations. These equations describe the gravitational field produced by any body, but as with all equations they constitute not so much an answer as a problem to be solved. And this, in turn, is no easy task. In terms of pure mathematical difficulty, Einstein's equations are among the most inaccessible and opaque of all the equations of physics. They are monstrously forbidding and complex. There is not one but 16 separate equations to be solved, each one a nonlinear partial differential equation for 16 separate unknown functions. These functions, in turn, have a very subtle interpretation, and even when the equations have been solved there is still much work to be done in arriving at a final understanding. Even today, more than half a century after Einstein formulated his equations, we know very little about their solutions, and there is an entire branch of physics devoted to their study. Scientists who work in this field tend to be a highly mathematical lot, and they think in terms of concepts so abstract as to lie beyond the concerns of even their fellow physicists. They call themselves relativists.

To Einstein, gravity is not a force at all but a distortion of the very nature of space and time, and its effects are far more subtle than Newton could have realized.

Schwarzschild's Solution to Einstein's Equations

The first person to find an exact solution to these equations was not Einstein himself. He had attempted to do so in his original paper setting forth the theory of general relativity, but he had not gotten very far, and he contented himself with an approximate solution. It was the German astronomer Karl Schwarzschild who obtained the first rigorously correct solution to the gravitational field equations, and the remarkable thing about his achievement is the manner in which it came about. Schwarzschild did not find the solution in a book-lined study. He found it while at war.

At the outbreak of World War I, Karl Schwarzschild was 40 years old, and he was one of Germany's most eminent astronomers. Behind him lay an impressive list of scientific achievements, and he had reached an age at which one might reasonably expect to settle down. Nevertheless his patriotic ideals made him feel it necessary to volunteer for the army. He served first in Belgium and then in France, and then was transferred to the Eastern Front. While in Russia he contracted the rare, painful, and incurable disease of pemphigus. Under the stress of war, under the stress of illness, Schwarzschild continued doing science. He worked out his solution to the field equations. Two months later his illness had become so grave that he was sent home to Germany. Two months after that he died.

Schwarzschild's paper announcing his discovery was published in the 1916 edition of the *Journal for the Royal Prussian Academy of Sciences*. It is titled "On the Field of Gravity of a Point Mass in the Theory of Einstein," and it sits right next to one by Helmreich on "Manuscript Emendations in Galen's Glossary to Hippocrates." The 1916 edition makes a hefty load—it runs to 1,400 pages—and in it are to be found articles on archaeology ("Contribution to the Study of Egyptian Religion"), astronomy ("On the Period of the Variable Star RR Lyrae"), and literature ("On the Upanishads"). There are minutes of Academy meetings and progress reports on its activities. And there is an obituary of Schwarzschild. It was written by Einstein.

Schwarzschild appears to have been pleased with his solution to Einstein's equations. In his paper he comments, "It is always pleasing to have exact solutions to problems," and, somewhat later, that it "permits Mr. Einstein's work to shine with increased purity." But there is no evidence that he took it very seriously. Beyond a certain satisfaction in good work well done, his paper conveys no particular tone whatsoever. Indeed, Schwarzschild's paper is remarkably brief—a mere few pages—and it is almost entirely devoted to mathematics. It sets forth his method of solving Einstein's equations and that is that. Nowhere in the paper is there to be found the slightest indication that something monumental has been found. Nor is there an

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indication that either Einstein or anybody else believed so. When Schwarzschild's paper was published it aroused no stir. The scientific community simply took note of it and continued about its business.

It is a measure of the complexity and subtlety of general relativity that this could be so. After all, in most branches of science, the hard work is over once a problem has been solved exactly. But here the work had only begun. It took Schwarzschild a matter of months to find his solution. It has taken us half a century to appreciate its full significance. Mathematically speaking, the Schwarzschild solution looks remarkably simple, and it is easy to write down. It is presented in all the textbooks. But beneath this apparent simplicity lies an extraordinary richness.

Furthermore, the solution is difficult to understand. It has a number of features that look positively impossible—pathological. So strange do these pathologies appear that physicists did not know how to proceed. As late as 1960 there was serious debate as to how they should be treated. One approach was to ignore the difficulties altogether. A widely respected textbook of general relativity published in 1965 does just this; it hardly mentions their existence. Another approach was to take them more seriously and claim that they threw the entire Schwarzschild solution into question. Einstein himself for a time took this approach, and at one point he published a paper attempting to show that the solution could never pertain to reality. As it turned out, he was wrong.

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The Revolutionary Nature of Schwarzschild's Solution

Only recently has the smoke lifted and the truly revolutionary nature of Schwarzschild's result been uncovered. Far from being mere annoyances, these pathologies are now recognized to be utterly fundamental in their significance. Only now do we understand the true nature of the Schwarzschild solution. The Schwarzschild solution describes the black hole.

Schwarzschild had not been looking for just any solution to Einstein's equations. He had wanted to answer a very definite question. He wanted to study the *gravitational field outside a spherical body.* The Schwarzschild solution was his answer.

The Earth is very nearly spherical, so the Schwarzschild solution applies to it. The same is true of the Sun. But neither of these bodies is a black hole. Their gravitational fields are entirely unremarkable and show none of the bizarre behavior characteristic of black holes. Nevertheless, in some important way the black hole and such prosaic bodies as the Earth and Sun are related. What is this relationship?

The relationship is *compression.* Any object can be transformed into a black hole by the simple act of shrinking it. This is the meaning of the imaginary experiment of crushing the Sun conducted earlier. At every stage in that process the gravitational field of the Sun was given by the Schwarzschild solution. When the Sun was relatively large that field was unremarkable, but once it had been compressed to a radius of 1.75 miles, a dramatic change had occurred: a change in which the Sun turned into a black hole.

Any object can be transformed into a black hole by the simple act of shrinking it.

This critical radius of 1.75 miles is of vital importance. It is so important that it has a name: *the Schwarzschild radius of the Sun.* It is the radius to which the Sun must be compressed in order for escape velocity from its surface to equal the velocity of light.

As for the Sun, relativists speak of the Schwarzschild radius of any object. The Schwarzschild radius of the Earth is one-third of an inch, that of our galaxy .03 of a light year. Scientists go further and speak of an object's *Schwarzschild surface.* This is the surface of an imaginary sphere whose radius is just the Schwarzschild radius of that object. The Earth's Schwarzschild surface, a mere fraction of an inch across, lies buried deep within it (see figure 1).

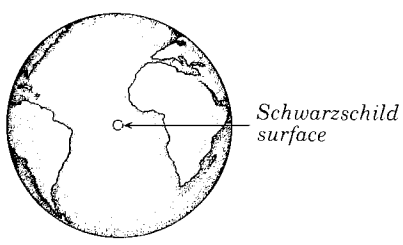


Figure 1

The Schwarzschild surface has no material reality. If we were to tunnel into the Earth until we reached a point one-third of an inch from its center, we would find nothing unusual there. It would be like standing in a cornfield precisely on the border between the United States and Canada.

But this is because the Earth is much larger than its Schwarzschild radius. So is the Sun and every star visible in the sky. Indeed, it is difficult to imagine an object so violently compressed that it lies within its Schwarzschild surface. Conversely, pulsars are almost so small. Certainly nothing prevents us from considering one as in figure 2.

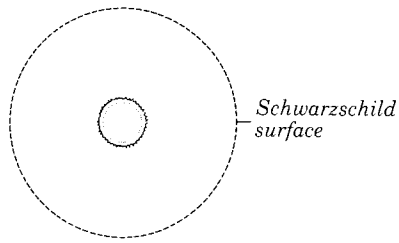


Figure 2

In this case the Schwarzschild surface lies outside the object. As in the previous example, it has no material reality. But unlike that example, it now has a vital significance. It is a black hole.

Epilogue

Modern research on black holes has moved far beyond Schwarzschild's original discovery, and nowadays it is couched in abstract, speculative terms. Scientists study the mathematical properties of new geometrics, and the issues they address sound positively bizarre to the untutored ear. Rotating black holes possess features that put more ordinary holes to shame. By dipping again and again into a spinning wormhole, a traveler could pass from one to a second universe, and then on to a third and a fourth, and so on endlessly. By a suitable choice of path he could travel backward in time. He could watch himself being born. He could shoot himself just before entering the rotating wormhole—in which case he never entered that wormhole at *all*, and never did shoot himself. . . . Philosophical questions on the nature of cause and effect in physics come to the fore in debating whether such geometrics should be taken seriously. And if an electric charge is added to the hole, its properties grow stranger still.

Perhaps most extraordinary of all is that these things flow from a theory proposed so very long ago. The age in which Albert Einstein developed relativity is long gone now, and few of its concerns remain alive to grip us. Nevertheless this creation, this marvelous structure, still rises to amaze and excite us. Nowhere in all of physics does general relativity reach so complete a development as it does in the study of black holes. Nowhere else does its beauty shine so brightly. The power of this theory, its inexhaustible richness, still hold us in its thrall.

reading *recommended by the book committee*

humanities FREDERICK J. CROSSON, ROBERT B. HEILMAN, ROBERT P. SONKOWSKY, LAWRENCE WILLSON

social sciences EARL W. COUNT, LEONARD W. DOOB, ANDREW GYORGY, MADELINE R. ROBINTON, VICTORIA SCHUCK, ANNA J. SCHWARTZ

natural sciences RONALD GEBALLE, RUSSELL B. STEVENS

ANNA J. SCHWARTZ

Presidential Economics: The Making of Economic Policy from Roosevelt to Reagan and Beyond. Herbert Stein. Simon & Schuster, 1984. $16.95.

This stimulating account of the economic policies adopted by successive administrations during the past half-century is the work of a master interpreter of the clash of short-term political objectives and the long horizon that noninflationary policy requires. Although economic performance was satisfactory until 1960, Kennedy and Johnson, displaying political oneupmanship, identified four problems—unemployment, economic growth, the quality of life, and poverty—to justify activist, fine-tuning policies. During the Nixon years, the short-term costs of implementing noninflationary policy were judged to be too great, so the short-run activist approach continued to dominate the political process to the extent that conservative economists with market-oriented ideas invoked price and wage controls. Despite his conservative leanings, Carter responded to accelerating inflation, growing budget deficits, and unlimited government expenditures with hesitation, again because of concern for the political costs that would be imposed by rising unemployment, deferred tax reductions, and cuts in benefits the electorate enjoyed.

Stein faults political influences on the Reagan program for the promises to reduce inflation without increasing unemployment, to reduce taxes without increasing budget deficits, and to cut government spending without hurting anyone. In a concluding chapter, emphasizing the need for a consensus to restrain the political bias toward the short run and special interest, Stein deplores the absence of a public discussion of standards, analogous to the balanced budget and gold standard rules of the past.

The Industrial Policy Debate. Ed. by Chalmers Johnson. Institute for Contemporary Studies, 1984. $21.95; paper, $8.95.

Problems the U.S. economy faces—loss of competitiveness by older industries, declining growth in productivity, regulatory and tax disincentives to investment and saving, communities affected by irreversible economic decline—have evoked a variety of proposals categorized as industrial policy to deal with the issues. Industrial policy is usually linked with advocacy of protection against import competition; industrial tax preferences; and government subsidies to targeted industries, sharing of the risks with industry through direct loans and loan guarantees, and financing of research and development and technical education. The editor of this volume is sympathetic to the idea of industrial policy but has included papers that are skeptical of its merits. The skeptics rate the experience of Western Europe and Japan as unfavorable to the general approach and present evidence against its specific elements. Probably the best case for industrial policy, made by one contributor, is the need for an industrial base to guarantee U.S. security requirements.

The Intellectual and the Marketplace. George J. Stigler. Harvard, 1984. Enlarged edition. $17.50; paper, $7.95.

Readers of this collection of fugitive essays, written over a period of 30 years but as timely now as at their original publication, will enjoy an encounter with the mind of Nobel laureate Stigler. Even the author's comment at the beginning of each piece on the occasion for it is enough to give the flavor of the man's wit and wisdom. Assembled in two parts, mostly about universities and all about economics, the collection ranges from spoofs of *Festschriften*, consumerism in education, and ways to pass examinations in economics to serious consideration of intellectuals' indictment of the marketplace. Stigler argues that dislike of the profit motive betrays misunderstanding of its role.

Deregulation and the New Airline Entrepreneurs. John R. Meyer and Clinton V. Oster, Jr. MIT, 1984. $22.50.

This study is an excellent analysis of the effects of the Airline Deregulation Act of 1978 in reviving entrepreneurial opportunities in the airline industry. The main focus is on the expansion of the commuter airlines and the new jet intrastate carriers in response to the elimination of most rate and entry regulations. The authors examine the role of fare reductions and no-frills service in stimulating demand for air travel in short- and medium-haul markets, the cost structure of air service in these markets, the financing of the expanding operations, and the competitive strategies of the airline entrepreneurs.

LEONARD W. DOOB

Vehicles: Experiments in Synthetic Psychology. Valentino Braitenberg. MIT, 1984. $14.95.

A delightful, whimsical, deceptively simple description of how, by means of relatively uncomplicated apparatus consisting of sensors and motors connected by ordinary wire and later by two imagined, "special" wires, it is possible to conceive of 18 increasingly complex, tabletop toy "vehicles" that appear to illustrate animal and human attributes ranging from reflexes and habits to foresight and "free will." In the last third of this slim monograph, the author, a biologist, relates the clever little models to current biological knowledge, including the "about 10 billion" nerve cells in the cortex. Of course, much about living matter thus viewed is "still a mystery," but the literal deus ex machina suggested here moves us a bit closer to the edges.

Refugee Scholars in America. Lewis A. Coser. Yale, 1984. $25.

A fascinating description and analysis of the academic and political lives and the innovative contributions of the scholars and scientists, most of them German and Jewish and almost all driven from their homes and universities by the Nazis, who have profoundly enriched American social science as well as psychiatry, psychology, philosophy, linguistics, literature, theology, history, and art history. Many, though not all, reacted creatively to their enforced or voluntary residence here. It is impossible to be concerned with one of these disciplines without recognizing or being influenced by one or more persons on the distinguished roster. Their reception by Americans is a sociological saga in its own right.

The Spiritual Nature of Man. Alister Hardy. Clarendon, 1979. $24.95.

A most sympathetic summary of the research conducted by the Religious Experience Research Unit at Oxford by the author, who is a distinguished, knighted biologist. Principal evidence for the conviction of a spiritual presence in consciousness comes from a series of 3,000 "occurrences" that have been assiduously collected in the United Kingdom and content-analyzed into a dozen categories ranging from "sensory or quasi-sensory experience" to "consequences of experience." The "occurrences" are described here at length, but only the age and sex of the informants are supplied. The few quantitative data from this sample and from other studies suggest that more women than men and more older than younger persons believe they have received such communication.

The Language of Riddles. W. J. Pepicello and Thomas A. Green. Ohio, 1984. $17.50.

A thoroughly linguistic, virtually social and psychological analysis of how any "riddler foists confusion on his audience by a variety of means" and strategies. Except for an appendix offering examples in Spanish, the illustrations come only from English. A serious understanding of this illusively amusing art form as well as its relation to proverbs and metaphors inevitably increases an appreciation of the subtleties of language. What has a bed but never sleeps? What has a mouth but cannot eat? If you really want to know, see the last word in the next review.

Historical Origins of the Concept of Neurosis. José M. López Piñero. Cambridge, 1984. $37.50; paper $12.95.

A detailed, quotation-packed history of the concept from its "coinage" in 1769 by a Scottish physician to its promiscuous use toward the end of the following century. The reader treks through a jungle of jargon and myriad modes of classifying human disturbances whose primary explanation almost always assumed a localizable, anatomical basis. Even before Freud, the term acquired a prefix that reflected a changed explanation: psychoneurosis. Like other human experiences, the transformation suggests that we never quite experience the same river.

LAWRENCE WILLSON

The Letters of Henry Adams, 1858–1892. Ed. by J. C. Levenson, Ernest Samuels, Charles Vandersee, and Viola Hopkins Winner. 3 vols. Harvard (Belknap), 1982. $100.

Rich, of illustrious lineage, well educated (as far as Harvard could make him in 1858), much traveled, intellectually curious, and informed about all branches of human endeavor, fastidious, and snobbish (pardonably so, perhaps), Henry Adams was a true aristocrat who demonstrated how a life of leisure can be productive. Almost every book he wrote has proved to be a classic, and these first three volumes (of a promised six) of his letters are surely the most informative, polished, and urbane letters

of any American of his time, or of any time. One looks forward impatiently to the continuation of this fine edition, which reveals a rather different Henry Adams from the frigid misanthrope Worthington Ford shaped by careful truncations in his edition of fifty years ago. Still mordantly witty, Adams is not the sour pessimist of legend. Still unwilling to suffer fools gladly—civilized fools, that is, in Washington and London—he cultivated friendships among the natives of the South Seas.

The Letters of Henry Wadsworth Longfellow, 1866–1882. Ed. by Andrew Hilen. Vols. V and VI. Harvard (Belknap), 1983. $80.

Andrew Hilen performed a patriotic labor by rescuing from oblivion and to some extent from critical obloquy the kindly and genial monument who was the most popular poet of his day in America, and, if the truth were spoken, probably still is among the members of Congress and common folks who have never heard of deconstruction and semiotics. In his poems he invented American history. These letters of his old age are not often of intrinsic interest, but occasionally one comes upon a phrase worth remembering, such as "They also work, who only sit and read." It is engaging to read of the dog Trap, who slept in a champagne basket and snored through the meetings of the Dante Club. In age, Trap grew "bald at the wrong end . . . like a baboon." "It is," wrote his master, "quite disreputable to walk with him." Chiefly, however, one admires Hilen's impeccable scholarship in recreating the Cantabrigian ambiance of a century ago. The six volumes, which began to appear in 1967, stand as one of the distinguished editions of this generation.

The Letters of Margaret Fuller, 1817–1844. 3 vols. Ed. by Robert N. Hudspeth. Cornell, 1983–1984. $75.

Strange it is that not until more than 130 years after her tragic death in a shipwreck in 1850 did anyone see fit to publish the letters of Margaret Fuller, "our most accomplished woman of letters" in the 19th century. As editor of *The Dial* (the high-minded journal of the Transcendentalists), as literary critic of Horace Greeley's *New-York Daily Tribune*, as the author of *Woman in the Nineteenth Century*, and later as revolutionary, she worked on a basis of equality with the most eminent intellectuals, artists, and statesmen of the day; surely she deserves an honored place in the feminist pantheon. She was also that rare, if not unique, creature, a Transcendentalist with a sense of humor. She had the critical acumen—and the nerve—to criticize Emerson for his narrowness of range, and she saw, as Emerson did not, that once the windy Bronson Alcott had discussed a project of reform (such as Brook Farm) with "a dozen people, it would have done its work, and truth be left unembodied as far as depended on him." Hudspeth, who will bring forth three more volumes, is another editor whose intelligence and care add luster to the chores of editorial work.

MADELINE ROBINTON

Prophecy and Politics: Socialism, Nationalism, and the Russian Jews, 1862–1917. Jonathan Frankel. Cambridge, 1981 (hardcover), $64.50; 1984 (paper), $18.95.

This is a fascinating book. Frankel, a graduate of Cambridge University and professor at Hebrew University in Jerusalem, has studied the impact on the Jews of the reaction to the enlightenment that crystalized in Russia in 1881 with the accession of Alexander III. This book is an enthralling, scholarly account of how the Russian Jewish community faced the pogroms, the increasing exclusion of Jews from the universities and the professions, the loss of jobs, and the expulsion from the cities. In particular, this is a study of how the Jewish intelligentsia tried to think through and act upon their solution to the dilemma of opposition to the autocracy as Russians and therefore as part of the various opposing groups or parties that emerged to fight the autocracy, or as Jews to solve their special difficulties. This is the story of those Jews that stayed to fight in Russia as socialists and those that emigrated to find their solution in Palestine or in the West, especially in the United States.

The Diary of Beatrice Webb. Vol. III. **1905–1924: The Power to Alter Things.** Ed. by Norman and Jeanne MacKenzie. Harvard, 1984. $25.

The third volume of Beatrice Webb's diary is every bit as engrossing as the earlier ones but in a different way. Because of its format and her perception and writing skill, it reads like a novel as she meets, entertains, and tries to influence the leaders of both political parties, Tories and Liberals, as well as Fabians and the emerging Laborites. Her brilliant comments are equally revealing of the people she writes about and of her own intellectual and emotional development. The diary covers the war years, the founding of *The New Statesman*, and the period when Sidney Webb drafted the new constitution and policy statement for the Labor Party, was elected Member of Parliament, and sat on the front bench of His Majesty's Opposition. An insider's story of a turbulent period.

A Man and an Institution: Sir Maurice Hankey, the Cabinet Secretariat and the Custody of Cabinet Secrecy. John F. Naylor. Cambridge, 1984. $54.50.

Characteristic of 20th-century government are the growing formalism of its structure, its bureaucratization, and the rushing into print by former wielders of power. Naylor assesses these aspects in the British government in this study of Sir Maurice Hankey, who established the formal secretariat for the Cabinet under Lloyd George and continued to mold it under successive prime ministers until his retirement in 1938. Hankey also formulated the policy of protection of Cabinet records, which had not existed before he became secretary because no written minutes had been taken at Cabinet meetings. Naylor also discusses the problems inherent in the question of Cabinet secrecy as the policy has evolved since that date.

Post-War: The Dawn of Today's Europe. Richard Mayne. Schocken, 1983. $16.95.

This book vividly recalls, often using eyewitness accounts, the events that occurred following World War II. Not only the political events such as the Nuremberg Trials, the Communist coup in Czechoslovakia that led to the death of Masaryk, and the Marshall Plan that led to the rebuilding of the Western Europe, but also the changes in fashions, in the arts, and in social mores are described in a most readable fashion. Mayne is a senior official of the European Economic Community and a friend and associate of many of the participants in these events.

The Palestinian Liberation Organization: People, Power, and Politics. Helena Cobban. Cambridge, 1984. $22.95.

Cobban, the London *Times* correspondent in Beirut from 1976 to 1981, here tells the remarkable story of how the PLO emerged as a force in international politics and how Yasser Arafat established his leadership in the organization. Despite Cobban's tilt toward the Palestinian cause in relation to Israel, this is a valuable book that traces the Byzantine struggles among the personalities involved and describes the PLO's relations with the Arab states, especially Jordan, Lebanon, and Syria.

VICTORIA SCHUCK

The Evolution of Cooperation. Robert Axelrod. Basic, 1984. $17.95.

As the dust cover states, this is a "path-breaking and provocative work," simply written and easily understood. The author, a political scientist and game theorist, furnishes bold answers to an age-old and, in today's world of nuclear threat, acutely important question, "Under what conditions will cooperation emerge in a world of egoists [individuals and institutions] without central authority [to police their actions]?" His theoretical propositions are sustained by such disparate and real-life examples as behavior of members in the U.S. Senate, actions of nations related to trade barriers, a live-and-let-live policy in trench warfare during World War I, a wide range of biological systems, Darwinian competition, and a computer tournament (an iterated Prisoner's Dilemma game in which the most successful rule proved to be Tit for Tat). He points to the potential of attaining cooperation by tacit evolution, without formal agreements in arms control. In offering guides to cooperation he explores the consequences of social forms and structures. A book for everyone including computer game players.

Packaging the Presidency: A History and Criticism of Presidential Campaign Advertising. Kathleen Hall Jamieson. Oxford, 1984. $19.95.

Political Innovation in America: The Politics of Policy Innovation. Nelson W. Polsby. Yale, 1984. $18.50.

The Political Presidency: Practice of Leadership. Barbara Kellerman. Oxford, 1984. $22.50.

Politics and the Budget. Howard E. Shuman. Prentice-Hall, 1984. Paper, $17.95.

The Reagan Record: An Assessment of America's Changing Domestic Priorities. An Urban Institute Study, ed. by John L. Palmer and Isabel V. Sawhill. Ballinger, 1984. $16.50.

Although five books met a publishing deadline before the 1984 presidential election and do not relate directly to the second term of an incumbent victor, they add significantly to the literature of the presidency and make rewarding reading for generalists and specialists in any season.

Jamieson's superb 15-year study of campaigns is a lively chronicle of the origin and development of advertising from the days of banners and handbills to the present current dominance of radio and television broadcasts. Her detailed chapters cover elections from 1952 through 1980. Whatever the failures of political ads, she holds that they are a safety valve channeling discontent and emphasizing the importance of the vote.

Polsby's study of policy innovation encased in witty prose examines the origin of eight

major government initiatives in scientific, foreign, and domestic policy following closely after World War II. He finds that some occur suddenly in response to crises; others incubate over a period of years. His generalizations are designed to help explain future innovations.

Kellerman examines leadership from the standpoint of presidential attributes necessary to fit into America's antiauthority culture and at the same time to exert influence over political elites. In a chatty manner she presents theory and traces how each of five presidents, beginning with Kennedy and ending with Reagan, sought to win adoption of his single most important domestic policy. She concludes that only the compleat politician has the necessary qualities for success. (Johnson and Reagan succeeded, the others did not.)

Shuman provides a comprehensive view of the presidential-congressional struggle over the federal budget resulting in the domineering control by the president. He takes the reader behind the scenes in the conflict determining the country's priorities.

The Urban Institute's study of the Reagan domestic record is the most extensive and meticulously researched yet to appear. One cannot begin to recount the wealth of data reported. Suffice it to say that report concludes that the domestic policy destined to be a Reagan revolution has turned out to be more of an evolution. The deficits are seen as a mighty legacy, and domestic spending and regulations "anemic." There are major accomplishments, but policies have frequently failed to live up to promises.

For a model of the presidency during a second term, readers may refer to Light's *President's Agenda* reviewed in this column Summer 1984. From empirical research Light concludes that a two-term president reaches the peak of his influence immediately after the second inauguration and that the period is very short. Watch Reagan for verification.

RONALD GEBALLE

The Montgolfier Brothers and the Invention of Aviation. Charles Coulston Gillispie. Princeton, 1983. $35.

The exploratory unmanned balloon flight of June 4, 1783, and events later that year and during the next form a fascinating tale. The extensive, paper-manufacturing Montgolfier family was populated with characters of many kinds. Joseph, the scientifically oriented dreamer, developed ideas about the effect of heat on gases and conceived the notion that balloon flight is possible. He persuaded his expediter brother Etienne to undertake the construction project. Etienne, in September 1783, demonstrated before Louis XVI and Marie Antoinette the flight of a sheep, a duck, and a rooster. Manned flight soon followed, as did a proposal for an airborne freight line; rivals and exploiters, too. In the next generation, Marc Seguin continued the family penchant for innovation by building the first cable suspension bridge in the world and the first railroad in France. The illustrations alone are worth the price of the book.

'Tabito' (The Traveler). Hideki Yukawa. World Scientific (Heyden), 1982. Paper, $14.

In 1934, at the age of 27, Yukawa proposed a revolutionary theory of nuclear forces that required the existence of a totally new, unexpected subatomic particle, the meson. Not until after World War II was his particle found. For the prediction he was awarded the Nobel Prize. These lovely, simple sketches of his life before his dramatic flash of insight are not about the meson, however; they are about a sensitive, withdrawn child and young man growing up in Japan. Even as a young man he could write this about a physicist and philosopher who influenced him: "In Kamakura, here in a deep and quiet valley, a man walks deep in thought."

Number Theory in Science and Communication: With Applications in Cryptography, Physics, Biology, Digital Information, and Computing. M. R. Schroeder. Springer-Verlag, 1984. $24.50.

Number Theory: An Approach through History from Hammurabi to Legendre. Andre Weil. Birkhauser, 1984. $29.95.

Whether invented by man or a deity, numbers (that is, the whole numbers) were particularly fascinating to the Babylonians (Weil cites a tablet from nearly 4,000 years ago), to the Greeks, and to some of the major mathematicians of the 18th and 19th centuries of our era. The unique properties of individual numbers and the many kinds of relationship among them were long regarded as the province of pure mathematics. Today this formerly esoteric branch is finding many applications, demonstrating once again the general rule that everything arising from the efforts of scientists is ultimately useful. Schroeder's book, an exposition of the field with many examples, is the more accessible to the newcomer. Weil's is about the evolution of the field, with detailed attention to the interactions among the many actors through the 18th century.

The Fractal Geometry of Nature. Benoit B. Mandelbrot. W. H. Freeman, 1983. $32.50.

Once again in the history of mathematics, the wildest dreams of the purest of scholars—invented to demonstrate mathematical constructions with which intuition could not cope—have been shown to have counterparts in nature. "Fractals" (a word coined by the author) are geometrical objects having dimensions that may be decimal rather than the one, two, three of familiar space. Nature's interest here lies in irregular shapes—clouds, mountain ranges, turbulent flows, and coastlines. (One of the inspirations for this work was the question, How long is the coastline of England?) Man's interest lies in describing such shapes and then handling their physics. Mandelbrot has created a new geometry that seems to cope with the description problem and now is catching the attention of scientists in a variety of disciplines.

EARL W. COUNT

Lucy: The Beginnings of Humankind. Donald C. Johanson and Maitland A. Edey. Simon & Schuster, 1980. $16.95. 1982 (paper), $9.95.

Happy campaigners write happy books. "Lucy" is the most ancient [illegible]man" now known—perhaps 3 to 3.4 million years—and more nearly complete than any other find. But more than half the book leads up to the find: the story of one and a quarter centuries of groping, floundering, succeeding. The authors (how they must have captivated their students!) do not spare us a modicum of the sweat, reasoning, talk, and cheering they bestow upon Lucy and other recoveries; and we thank them for the compliment. An ancestor at last?

Archaeoastronomy and the Roots of Science. Ed. by E. C. Krupp. Westview, 1984. $42.50.

For primitives and ancients, the sun, moon, and stars were integral parts of their worlds of action: solstices, lunar cycles, constellations, conjunctions. Understandably, tropical and temperate latitudes see different heavens. Earlier men were concerned with their dreadful supernatural power to affect the fate of men. Seafarers found navigational guidance. Mayans astronomized to predict cosmic crises. Egyptians, especially in their Sirius and solar rituals, sought renewal of a living world. The most informative essays are decidedly technical, but not beyond lay readers' comprehension. Inexplicably, this symposium does not treat Mesopotamia. In summation, rituals and myths were the metaphors that conjoined celestial reality with human valuations.

The Study of American Indian Religions. Ake Hultkrantz. Crossroad, 1983. $12.95.

The American Indian religions are unexpectedly profound, expectably human, and well demanding of our thought. This insight has taken three centuries to develop. The writer, an international authority, critically examines the three centuries of American and European scholarship on this subject and urges us to deeper insight and increasing purpose.

The Book of the Life of the Ancient Mexicans. Vol. I. **The Codex Magliabechiano and the Lost Prototype of the Magliabechiano Group.** Vol. II. Zelia Nuttal and Elizabeth Hill Boone. California, 1983. $73, the set.

Volume I is Nuttal's 1903 introduction and facsimile; it catalogues the Aztec "demons" and reproduces with faithful crudity the priestly garb signaled in each example. Volume II picks up the study over the past three-quarters of a century and pursues the historical tortuosities of the "group" which the Codex has outlived.

The Genius of Arab Civilization: Source of the Renaissance. Ed. by John R. Hayes. 2nd edition. MIT, 1983. $25; paper, $10.

In its heyday, Arab culture was cosmopolitan—creatively open to ideas of the (non-Christian) Greeks, Indians, and Persians. The 12 contributors, mostly Arabian, range over the domains of high culture skillfully if not flawlessly. A survey can only introduce; appended is a roster of further recommended readings.

Historical Atlas of World Mythology. Vol. I: **The Way of the Animal Powers.** Joseph Campbell. Alfred van der Marck, Harper & Row, 1983. $75.

The global spread of man and his artifacts is oft told; the global epic of his intellectual adventure not so. Myth and ritual dawned, unchronicled, with the mind that wondered, conjectured on death, spirits/deities beyond human powers, the mystery of femaleness. That mind also invented the shaman—the oldest profession. Our earliest evidence is the Neanderthalers' bear-cult; the latest event, the survival of oral traditions.

As backdrop to the epic, the author includes the fossil traces of the man-apes and ape-men whence issued the lineage of Homo: at least, they conceived percussion and cutting. Plains, deserts, ice-fields, seacoasts, jungles imprinted the diverse world views of hunters and gatherers; myth-motifs may change over space and time, but awe and human inadequacy endure.

This volume treats the world views of hunters. Volume II will turn to villagers.

The Attack on the Reader

(From Swift: The Man, His Works, and the Age, *Vol. III, pp. 468–69, by Irvin Ehrenpreis.)*

Few readers of *Gulliver's Travels* come away from it feeling that the author has strengthened their devotion to Christianity. So it is fortunate that Swift's real argument lies elsewhere. By locating it not in the soul but in the body, Swift can simply compare the account of human nature generally accepted with the data of experience. He can set our theory of morals beside our visible practice. If religion has failed to touch the hearts of men, perhaps they may be moved by elementary shame, by the sight of the abyss between the principles they themselves preach and the corruption of their lives. Merely on the grounds of enlightened self-interest they may then turn away from their deformities.

This is why Swift chose a repetitive, narrative fantasy. In his story, the inventive form, the imaginative incidents, and not the doctrine, are what touch us first and draw us in. The social or political institutions we hear about come before us first as phenomena to be examined, not as teachings we must accept. They belong to a comic fantasy that may refer to us but that seems initially self-contained and no attack on our character. We begin as external spectators, privileged to criticize not only these remote and freakish people, but the narrator himself. Inevitably, we go beyond acceptance and rejection; for soon, half-consciously, we set up our own ideals beside theirs. We are lured into competition with Gulliver, whose judgments often put us off.

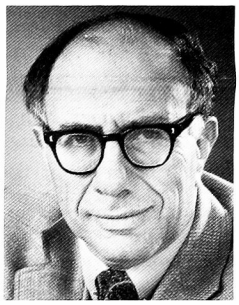
Ruined Cities of the Mind

(The opening paragraph from Against the Apocalypse: Responses to Catastrophe in Modern Jewish Literature, *by David G. Roskies.)*

There are said to be Moroccan Jews who have kept the keys to their ancestral homes in fifteenth-century Spain and Portugal. When, in the 1950s, the exiles dispersed yet again—to France, Quebec, and Israel—these metal relics from Seville and Granada, Lisbon and Barcelona, became perhaps their most tangible link to their great Sephardic past. Such keys may not in fact exist; but even so, they intrigue as metaphors. Something like a key, for instance, must have been passed on from parents to children as part of the Jewish emigration during and after World War II. How else can I understand why the immediate but severed past exerted such an enormous claim on my loyalties? The Lithuanian city of Vilna in particular, with its unique blend of tradition and secularism, became something of a lost temple to me, a symbol of what eastern European Jewry had achieved in its eight hundred years of settlement. Though my parents had left Vilna in 1930, almost two decades before I was born, its people and places were more real to me than those of Montreal. In our family, distances were measured according to a prewar map: a shopping expedition to St. Catherine Street in Montreal, for example, was described in terms of the distance from my mother's former house on Zavalne, corner of Troke, to the Vilna train station. When I actually had occasion to walk the latter route in 1971, I knew my way instinctively, despite the new street signs—Komsomol Street, Red Army Avenue, Lenin Boulevard.

2ND Annual Romanell Lectures Set for March–April

"Moneybags Must Be So Lucky!—Reflections on the Philosophical Significance of the Literary Structure of Marx's *Capital*" is the title of a three-part series of lectures to be delivered by Robert Paul Wolff on March 27, April 3, and April 10 in Amherst, Massachusetts. Wolff, who holds the 1984 Romanell-Phi Beta Kappa Professorship of Philosophy, will speak at the University of Massachusetts, where he is professor of philosophy. The professorship is intended to recognize not only distinguished achievement but also the recipient's contribution or potential contribution to public understanding of philosophy.



Robert Paul Wolff

1985–86 Recipient Named

Alasdair MacIntyre, professor of philosophy at Vanderbilt University, has been appointed to the Romanell-Phi Beta Kappa Professorship in Philosophy for 1985–86.

Associates Elect Officers

Stanley A. Frankel, a senior officer of the Ogden Corporation, New York, and adjunct professor of Baruch College and Pace University, was elected president of Phi Beta Kappa Associates in October. Other officers are Madeline McWhinney Dale and Gerard Piel, vice presidents, and George P. Jenkins, secretary-treasurer.

The Key Reporter

volume 50 • number two • winter 1984–85

Editor: Priscilla S. Taylor

Consulting Editor: Kenneth M. Greene

Editorial Committee: Irving Dilliard, William F. Hahnert, Robert H. Irrmann.

The Key Reporter is published quarterly by the United Chapters of Phi Beta Kappa at the Garamond/Pridemark Press, Baltimore, Maryland. Send all change-of-address notices to *The Key Reporter*, Phi Beta Kappa Editorial and Executive Offices, 1811 Q Street, N.W., Washington, DC 20009. No responsibility is assumed for views expressed in articles published.

Single copies 20¢, ten or more copies 10¢ each.

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