
Stories, Geoffrey Bowker notes, are told in a context. The “traces” we leave behind are not unmediated reflections of what has occurred, but “tacit negotiations between ourselves and our imagined auditors.” The act of committing to record, then, does not occur in a vacuum, but is embedded within a set of technical, social, and formal practices—which the author terms “memory practices.” While such assumptions should come as no surprise to historians, Bowker points to such practices in the sciences as a particularly interesting case. Scientists are exceptional in the extent to which they claim perfect memory of their past. This claim is grounded in the central role precise measurement of time plays in the sciences and the extent to which record of the scientific present (a scientific paper, for example) purports to embody all the pasts of the discipline. Yet the past scientists create is not perfect. Bowker’s task is to uncover the techniques and technologies, the drawing of boundaries, and the discontinuities central to shaping the past in the scientific present.

Bowker frames his unraveling of memory practices not as linear narrative, but through space in units called “archives” and through time in units called “memory epochs”—from the 19th, 20th, and 21st centuries. Bowker is interested in these epochs as epistemic breaks in that each new epoch renders knowledge of the previous age irrelevant; the archive determines that which can and cannot be remembered. Invisibly, imperceptibly, the archive orders the records that belong, and excludes those which simply do not fit. Bowker considers memory practices of the 19th century in geology, and finds, in a theme weaving throughout the text, that the organizational modes of the discipline are reflected onto nature. To represent this finding the author calls on the imagery of a Möbius strip, in which the work internal to the discipline is reflected in the scientific output. Bowker makes a similar argument of the tendency of cyberneticians of the mid-20th century, to recapitulate
their constructed history of the discipline in their scientific work. These cybernetic avatars of his second memory epoch destroy memories of temporal and disciplinary boundaries in their quest to develop a universal discipline. The memory epoch of the 21st century which Bowker explores is the epoch of “potential memory”—databasing the world for the purpose of making remembrance possible should the need arise. Through databasing practices broadly defined, including banking DNA and sperm, to the Genome Project, to the field of biodiversity, Bowker notes that we risk losing both our past and our future.

Bowker offers a playful and richly textured look at the way we maintain records of the past and the multitude of purposes such memory practices can serve in the present. In so doing he reminds readers that the context in which we record the past shapes the stories we can tell.

Stephanie Young


Carson’s book speaks to a wide audience. Philosophers, historians, political scientists, and psychologists alike will find The measure of merit a rewarding read. Richly nuanced and informed by a diverse collection of sources, this book documents how the French and American republics reconciled the tension posed by egalitarianism and meritocracy in the face of what seem to be natural intellectual hierarchies.

Part I, “Mental abilities and Republican cultures,” shows how the language of “talents” and the associated philosophical ideas concerning the nature of the mind influenced the social, political, and bureaucratic structures of nascent American and French republics during the late 18th century. Carson argues that the dominant philosophy of mind played a significant role in the centralization and bureaucratization of education in France, and additionally, that differences in philosophical ideas regarding the structure of the intellect help explain differences between French and American educational systems in the late 18th century. Carson documents the rise of physical anthropology (and craniometry) and the science of race, thus paving the way for differential psychology.

Part II, “Individualizing intelligence through the science of difference,” details how intelligence became operationalized and the object of scientific study. Carson’s story is a compelling one, noting the confluence of philosophical fashion, viz positivism (and consequent turn away from Lockean faculty psychology), the acceptance of neo-Lamarkian natural hierarchies, and education policy in France. This complex web of influences culminated in the emergence of psychology as a laboratory science and the development of the Binet-Simon intelligence scale. Carson explains why the Binet-Simon scale, which suffered a relatively cool reception in France, was, by contrast, enthusiastically received by American psychologists. Originally designed as a diagnostic tool for testing children and the feebleminded, Lewis Terman revised the Binet-Simon scale for the population at large and renamed it the “Stanford-Binet Intelligence Scale.”
Part III, “Merit, matter, and mind,” continues the history of IQ and its acceptance into American culture, and would be of particular interest to historians and philosophers of psychology and psychometrics. Carson meticulously details Robert Yerkes’s campaign to incorporate mental ability tests into personnel selection in the American military during World War I. The war required that America mobilize a military force quickly and channel recruits into appropriate positions. Mental tests were responsive to this urgency. In France, however, there was already an organized standing military. Moreover, trust in the judgment of the military elite trumped the results of any mental test. Their successful implementation in the American military secured the future of mental tests in America, sparing them the fate of the eugenic ambitions that initially motivated their adoption. Though in America the popularity of intelligence tests has waxed and waned over the century, in France the results of mental tests never supplanted the opinion of the elite or the results of the concours; mental ability tests were thus rendered redundant by the extant merit structure in the French educational system.

S. Brian Hood


*Les sciences pour la guerre* brings together several papers delivered during seminars and conferences organized by the Centre Koyré in Paris from 1998 to 2001. The book aspires to provide an account of current research into relationships between science, technology, and society during and after World War II. Though most of the studies deal with the situation in the United States, the book includes a discussion of the French and Soviet cases as well.

Particularly remarkable are the two articles from Dominique Pestre (an editor of the volume), which attempt a general synthesis of themes that would have otherwise remained scattered. These pieces advance a major thesis of which the rest of the book may be conceived as defense and illustration. It is well known that the war considerably transformed not only the modes of financial support for research but at a more profound level, the scientist’s craft as well—especially for the physical sciences—through such changes as the role of instrumentation and the success of a phenomenological approach. This collection sheds new light on this post-war period, especially on new models of public administration and management proposed by scientists to statesmen. It explores programs for rationalizing social action grounded in new formal approaches, with the ideal of real-time information processing. Hence the question is no longer: how did politics affect science, but how did the sciences get into politics? According to the authors, the distinguishing feature of the period 1940–1960 is a new conception of science, an almost mystical belief that scientific techniques paired with sufficient money and time can resolve all problems, especially military ones.

Some recurrent themes appearing in these articles explore new modes of rationality—first developed during the war—including game theory’s complex status at the Rand Corporation (Leonard), the weight of computer simulations (Galison),
the new tools of information theory and cybernetics (Dahan, Edwards, and Kay), operational research and linear programming (Pestre) or planning models for state health policy (Gaudillère). It provides readers with a stimulating, readable, and timely account of the subject while offering pointers to new fruitful areas of research—such as the question of resistance to these new usages of sciences.

Mathieu Tricot


Davidson, a lawyer, co-founded the Channel Tunnel Study Group in 1957 and remained with the project through its completion in 1994. During the intervening years he coordinated the Macro-Engineering Research Group at MIT’s School of Engineering. Lusk Brook founded the Center for the Study of Success and has taught at MIT and the Radcliffe Institute. Their two-volume collection analyzes ambitious engineering accomplishments from Solomon’s Temple (c. 960 BCE) to Boston’s Central Artery/Tunnel Project—the Big Dig—(completed in 2006). Each entry places the project in its social and economic context, provides construction plans and agreements, and mentions its impact on future construction. All fall within the editors’ definition of macro-engineering: “the largest and most complex technical projects that can be accomplished in any given period of history.” Not surprisingly, there is a pattern to the kinds of projects that demand this kind of planning, one of which is water.

The ancient Romans solved their thirst by constructing aqueducts. The Dutch solved their problem of too much water by constructing a system of dykes that, as a byproduct, provided reclaimed, arable land. Efforts to straddle waterways inspired the construction of bridges, including the longest span (at the time) and deeply anchored Brooklyn Bridge (completed in 1883). Equally daring engineers turned to tunnels to keep traffic flowing beneath cities for urban trains and between land masses, one of the most ambitious of which, the Chunnel, now connects Britain with France.

The encyclopedia includes plans for creating cities out of whole cloth including Baghdad in 762, St. Petersburg in 1713, Washington, D.C. in 1792, and Abudju, Nigeria in 1976. Each project, be it bridge or city, faced different obstacles, found new solutions, and succeeded, albeit with glitches. Twenty-four workers died building the Brooklyn Bridge, including its designer John Roebling; a Boston commuter was killed when part of a roof collapsed on the car she was riding in (that occurred after the manuscript was in press) in 2006. The multifaceted Boston project faced challenges that would likely have been inconceivable to engineers in ancient or medieval cultures. By the 20th century engineers had to plan to restore green spaces and reverse environmental decay while providing better roads and tunnels. These new challenges demanded fresh thinking that in the United States has been fulfilled, in part, by the creation of a National Trails System that often
uses abandoned railroad beds for hiking and cycling paths (an on-going project). In Boston the Big Dig includes the creation of 200 new acres of green parks near the waterfront, thanks to the enterprise of macro-engineers. One could fault the necessarily incomplete list selections in these volumes. Perhaps the editors could have included examples of controversial projects such as China’s Three Gorges hydroelectric dam. That said, what is included is unique in the attention they draw to the vision, the details of construction, and the historical ramifications of these audacious, outrageous, and ultimately successful giant engineering feats.

Bettyann Holtzmann Kevles


Scientific theories perform two functions in Peter Dear’s new book. First, theories provide accurate descriptions of natural phenomena; second, they offer predictions about how those phenomena will manifest in the future. Theories meeting these criteria are “instrumental;” we prize them for their practical utility as they often result in technological advances. But we also value scientific theories for their ability to represent the world as it really is, to depict reality. In this second sense, theories are meant to be true, their models are faithful and their hypothetical entities (e.g., fields and particles) actually exist. Dear argues that instrumentalism and realism (or the “historical” and the “philosophical” tendencies—“the intertwining pillars of modern science”) are interwoven in every scientific theory. The history of science since the 17th century has been shaped in large part by the often opposing pulls of these two strategies for making sense of the very complicated natural world.

Support for Dear’s scheme comes from a series of examples spanning four centuries. These include several foundational and revolutionary episodes in the history of science: Newton’s gravitational theory, Linnaeus’s and Cuvier’s classificatory schemes, Darwin’s evolution, Maxwell’s electromagnetism, Schrödinger’s and Heisenberg’s competing approaches to quantum mechanics. In a sophisticated way, each exhibits what Dear calls an “amalgam” of instrumentality and natural philosophy. From these stories Dear extracts a debate about the purpose of science, the unifying theme of his narrative. For instance, the theory of electromagnetism developed by Faraday, Thomson, and Maxwell in 19th-century Britain combines an advanced mathematical treatment with a rejection of the physically unsatisfactory concept of action at a distance. To make the phenomena of electricity and magnetism intelligible, these physicists at first developed models that corresponded to a sensible picture of reality. But in the end, for Maxwell at least, the mathematics was more important than the model, and his theory’s chief virtue became its instrumental utility, especially its applicability to telegraphy.

Dear has identified a fundamental tension in the history of science—it arises from two very different ways of conceiving of the purpose of scientific explanation. The demand that science provide a true and meaningful understanding of the natural
world, if often at odds with the goal of providing new and useful technologies. Today, in large part because scientists’ vast budgets depend on public support, this tension has led to an emphasis on science’s instrumental achievements. Dear argues convincingly that these competing conceptions have profoundly shaped the modern scientific enterprise and the meaning of scientific understanding since the early 17th century.

Kalil Oldham


No prize bestows on its recipient (and his or her institution and country) greater public recognition and honor than the Nobel Prize. Given its influence, it is not surprising that judgments other than merit taint the selection process. Einstein’s Nobel Prize of 1921 is no exception.

Between 1910 and 1922, physicists from 12 nations nominated Einstein 60 times for the prize. His candidacy was strong: Einstein’s papers on the quantum theory of radiation received 16 nominations, Brownian motion 11 nominations, and the special or general theories of relativity 71 nominations. It was obvious to all leading physicists that Einstein deserved the honor, but members of the Nobel Committee for Physics, the committee that recommends candidates to the Royal Swedish Academy of Sciences, judged Einstein’s work to be lacking. Finally, in September 1922, Carl Wilhelm Oseen from Uppsala became a member of the Physics Committee and with a clever strategy turned things in Einstein’s favor.

The author guides the reader through the deliberations of the Physics Committee over the period 1910 to Oseen’s intervention in 1922. These deliberations—typically convoluted, often illogical, sometimes confused by misconceptions, and frequently biased—went beyond Einstein’s work and included arguments about the nature of physics and its connection to the larger culture. The bias was undisguised. Relativity was said to lie “entirely outside the realm of experience and can therefore only be embraced through belief” or “as an article of faith” (p. 149). Regarding Einstein, one member said, “Einstein must never receive a Nobel Prize even if the whole world demands it” (p. 160).

The prize was deferred in 1921. In 1922, Oseen’s strategy linked Einstein and Bohr. Oseen changed a word: the “theory” of the photoelectric effect became the “law.” (Oseen may have anticipated his strategy: he nominated Einstein in 1921 and 1922 for “the law of the photoelectric effect.”) Then he developed the argument that Bohr’s atomic theory rested on this law; it was Einstein who showed that “the magnitude of \( h \) has a radical significance for the whole of atomic physics” (p. 164). Furthermore, “Einstein’s law of the photoelectric effect and Bohr’s quantum rule of energy absorbed or emitted when electrons jump between orbits, the ‘frequency condition’ attending his atomic model are indeed identical” (p. 167).

Oseen’s strategy succeeded and Einstein was awarded the deferred 1921 prize and Bohr the 1922 prize. One question is left unanswered by the author: was
Oseen’s strategy simply a means to a desired end or did he really believe that, from all of Einstein’s momentous accomplishments, it was a law about the photoelectric-effect, a second-rate physical phenomenon, that deserved recognition? Whatever the answer, the Nobel Committee’s decision has had the sad consequence that Einstein’s revolutionary particle-of-light paper is routinely trivialized by the practice of calling it the photoelectric effect paper.

John S. Rigden


This tidy tome is a synthesis of many years of thought and work by Thomas Hughes. While Hughes has always chosen a large canvas, he has seldom used the large brush strokes with which he portrays the history of technology in the Human-built world. All of his principle characterizations of technological development, from reverse salient to systems-builders find a place and ample illustration, but those seeking the full argument will have to look elsewhere in his corpus. The book is intended for a broad audience that is uninterested in the details of hardware and the complexities of software, seeking rather a user-friendly interface to what has become, largely thanks to Hughes, a professional discipline with all of the arcana and argot becoming to such an academic enterprise.

Hughes considers technology from a variety of perspectives in order to demonstrate the forms of creativity expressed by American inventors, engineers, architects and planners. The technological developments in 19th-century America took their inspiration, he argues, from an ideology that casts the new nation as a “city on a hill,” one of the mainstays of American exceptionalism, that also spawned “Manifest Destiny.” For Hughes, however, this evocation of a “divine spark” enabled Americans to conquer the North American continent (or at least its more temperate zones). Here Hughes draws heavily on Leo Marx’s concept of The machine in the garden, as well as primary sources that have appeared in his edited works Changing attitudes towards American technology and Development of Western technology since 1500. He shows how technology offered a passport to paradise in theory and a royal road to profits in practice in 19th-century America.

The chapter “Technology as machine” reflects Hughes’ interests in Edison, Ford, and other turn-of-the-century inventors, who represented a symbiosis of democracy and technology in the mass production and distribution of goods. These were the beneficiaries of the second industrial revolution, and Hughes compares them with the other nation pre-eminent in this transformation, Germany. Both countries, he argues, saw technology as a means to construct the modern metropolis. In both, system-builders deployed the infrastructure that made urban life comfortable and convenient. Like Laplace, they no longer needed the “divine spark” to ignite their energies. Replete with resonances of American genesis, this section, like its predecessor, also dwells on cultural reactions to technological arrogance of the conquerors of the material and natural worlds, who now substituted their
human-built world for the garden of Eden envisaged by 19th-century creators of rural environments linked by steam-engines and canal boats.

Hughes is more comfortable with technology as systems, controls, and information, and elaborates the rise and fall of the systems approach under military patronage and counter-cultural criticism, culminating in the Information Revolution that spilled from the failure of systems and the loss of control that undermined the modern consensus on reason, science, and progress in the Vietnam era but spawned computer technology and smart weapons that gave a fin-de-siècle boost to technological enthusiasm. Having disposed of the counter-culture, Hughes returns to technology’s contributions to high culture in the fine arts of the 20th century, from Dada to Duchamps, and from the Bauhaus to industrial design. The artistic celebration of the modern, however, also was muted by reactions to order and control that characterized the European and American scene throughout the century.

In his final section, Hughes lays out his hopes for a synthesis of the technical and ecological in an eco-technological environment. Here the themes of the book converge in an optimistic vision of nature-friendly technology. Curiously, he does not comment on the global conflict between the economy and the environment represented by the accumulation of greenhouse gases and other waste products of modern technology, which are unlikely to find a technological fix. The capitalist system, after all, escapes his analysis, even though its techniques are driving technology more forcibly than any artist, musician, engineer or architect has ever done. Although his canvas is vast and his brush-strokes are vivid and broad, they may obscure as well as illustrate the nature of the human-built world, and do not persuade this reader that his is the only way to think about technology and culture.

Robert W. Seidel


Holography is a unique development in postwar science, as it meant so many different things to different contributors and users at different times. From the late 1940s to the 1990s, a variety of global actors researched ways of using wave interference techniques to display three-dimensional images. In the end, while holography was borne of rigorous scientific inquiry, it made its greatest mark in art and entertainment. This unexpected trajectory from scientific promise to novelty turns out to be staggeringly complicated. This is the story Sean Johnston tells in his meticulously researched monograph, *Holographic visions*. In order to narrate the story without losing the complex social texture, Johnston examines the formation and interaction of several overlapping scientific communities, melding historical research with STS approaches including the sociology of techno-scientific communities; networks of scientists, instruments and resources; and a demand for account symmetry between holography’s winners, like Denis Gabor, who won the 1971 Nobel Prize, and others, like Charles Vest whose work on holography has been overshadowed by his career as the President of MIT. This successful blending of historical methods and STS framing is demonstrated by Johnston’s selection of the
four critical components of holography: a unique intellectual subject, a set of technologies with specific capacities, the growth of communities and social practices, and a commercial economic and cultural activity. Even for readers only peripherally interested in holography, Johnston’s book is a valuable methodical model.

Johnston’s account begins by setting up the three principal sites at which holograms were being developed between the 1940s and 1960s: Gabor’s lab, first at the British Thomson-Houston Company then at Imperial College, London where holograms emerged from improving electron microscope images; the world’s largest optical institution at the Vavilov Institute in Leningrad where Yuri Denisyuk was trying to record the reflecting properties of objects; and the Willow Run laboratory in Ann Arbor Michigan, where Emmett Leith performed classified, Air Force–sponsored research on synthetic aperture radar, a way of optically processing radar data. All three sites were trying to reconstruct different wavelength interference patterns using visible light. Therefore, at the heart of Johnston’s account is a complex priority dispute, which hinges more on defining holography than on who did what, when. In describing the formation of communities Johnston starts with these three principal sites, but even they are more involved than they initially appear. For example, in Ann Arbor, Leith’s work was entangled in disputes with George Stroke at the University of Michigan’s Electro-Optical Sciences Lab and generated a series of Ann Arbor start-up companies. Johnston’s description of the landscape of holography is the most surprising and satisfying dimension of the book, since he is looking at the way knowledge moves—from the academy to the private sector, across national lines, and from the laboratory to art and entertainment. Many of the currently fashionable accounts of the “new” commercialization of science, including Vest’s own collection Pursuing the endless frontier argue for similarly complicated social landscapes but without Johnston’s thick description. In the end, though Johnston’s account is dense reading, it is a model account of recent science, and is particularly notable for spanning the Soviet-West line that many historians of science assume to be a harder barrier to the transmission of knowledge than Johnston’s account demonstrates.

Ann Johnson


While the flood of recent scholarship on alchemy has reinvigorated the field and articulated its importance in shaping early modern intellectual culture, the linguistic complexity and stylistic oddity of the primary sources have made the field difficult to navigate or teach. Stanton J. Linden’s *The alchemy reader* takes a step toward making these sources more accessible, providing twenty-seven excerpts from previously published translations of alchemical texts accompanied by examples of alchemical imagery. The selections, which average eight pages each, describe various aspects of matter theory, transmutation, and Hermeticism. The passages, each accompanied by short author-biographies, are arranged chronologically.
While a potentially valuable resource, the book has several features of which the perspective reader should be aware. The twenty-seven passages, representing more than two millennia of alchemical writings, are united by no obvious selection criteria or intellectual lineages. Without such a structure, the Reader does not seem likely to make the complexities of the source material easier to navigate. More seriously, problems with the authorial attributions and textual validity of the selections make the book a problematic source for serious scholarly research. Many of the attributions have been overturned by recent scholarship, and while in many cases Linden acknowledges the complexities of attribution, they supply the reader with information that is at worst incorrect, and at best misleading. Furthermore, the translations used for many of the Greek, Latin, and Arabic texts are drawn from early modern translations or from non-scholarly chemical newsletters and are of questionable utility for serious research.

Matthew Sargent


This book expands on a theme that Ernst Mayr had addressed in earlier works, including *The growth of biological thought* and *Towards a new philosophy of biology,* namely, that the biological sciences constitute a distinct type of science, and that fully understanding biology requires building a conceptual framework for the history and philosophy of biology that is distinct from that of the physical sciences. Mayr identifies four core principles of the physical sciences—essentialism, determinism, reductionism, and universal applicability of laws—that, he argues, are either absent from or irrelevant to the study of living organisms. Biology and its allied fields, according to Mayr, have a necessarily historical component, and inherently deal with probabilities rather than certainties. Mayr’s overarching argument in this book is that developing a true philosophy of biology, or coming to a meaningful understanding of the history of biology, requires a deconstruction of our concept of “science,” because using the physical sciences as our standard model has resulted in a distortion of our models. One might at various points wish that Mayr had brought this work in closer dialogue with the existing scholarship, especially during his discussion of the inapplicability of Kuhn’s “normal science” model to the biological sciences. Overall, though, this book offers a well-reasoned and persuasive argument in favor of treating the biological sciences as autonomous disciplines.

Susan Marie Groppi


This is a selection of unpublished essays, travel logs, notes and brief published scientific writings by Edward Ricketts, a naturalist who was the model for “Doc” in John Steinbeck’s novels *Cannery Row* and *Sweet Thursday.* A mostly self-taught naturalist with a compulsive need to organize and classify information
from any source, Ricketts fashioned a holistic worldview that drew on his studies of marine ecology, human behavior, various philosophical and literary texts, and Zen Buddhism. His lifelong intellectual aim was to understand how everything was connected. These writings show him grappling to articulate this holistic vision.

Ricketts was introduced to ecology through Warder Clyde Allee’s course at the University of Chicago. Moving to California in the 1920s, he set up a small business supplying biological specimens to schools, while hobnobbing with local writers and studying the natural history of the seashore. His best-known scientific work, *Between Pacific tides* (1939), was innovative in classifying animals by their different habitats. His friend John Steinbeck published an account of their exploration of the Gulf of California, *The log from the Sea of Cortez*, which was a commercial failure. Steinbeck used Ricketts’s essay on “non-teleological thinking,” reproduced here along with Ricketts’s notes from the trip. Ricketts argued that certain kinds of causal analysis involved inappropriate moral judgments and that it was preferable to develop a holistic and less judgmental understanding of the complex connections and relationships that made up the world. Ricketts’s notes on a trip to Vancouver Island and the Queen Charlotte Islands in the 1940s contain observations on local natural history and customs, but remain unanalyzed and episodic, although they show his increasing interest in the interconnectedness of humans and nature.

A biographical essay by Katharine Rodger extols Ricketts as a prescient ecological thinker from the 1920s to his untimely death in 1948. But the essays reveal that, like many autodidacts, Ricketts wrote more for himself than for others, piecing arguments together from his experiences and eclectic reading, as though he were trying to organize his ideas and work out a personal philosophy through his writing. The unpublished essays are difficult to penetrate and have a raw quality, although for devotees of Ricketts the volume provides insight into the thought processes of an eccentric character, the scientific counterpart to the visionary artist and source of inspiration for Steinbeck.

Sharon Kingsland


In *Darwinism and its discontents*, Michael Ruse mounts an ambitious defense of Darwinism against its opponents on all fronts. Who are these detractors? First and foremost among them are the Creationists, old-fashioned biblical literalists and more recent advocates of Intelligent Design. Not far behind them, though, are the “large numbers of people [who] stand virtually back to back with the religious critics”: cultural anthropologists, sociologists of science, Marxist biologists, and social constructionists of all stripes. By the end of this wide-ranging polemic, Ruse has not only taken on familiar anti-evolutionists like Jonathan Wells of the Discovery Institute and theistic philosopher Alvin Plantinga, but also less obvious enemies of Darwin, including the novelist Ian McEwan and Stephen Jay Gould.
Darwinism and its discontents is divided into twelve chapters, each of which addresses a different topic. Though the chapters are intended to be read together, many of them could stand alone as short, descriptive essays. What is impressive about the book is its span, addressing in less than 300 pages many complex scientific ideas, as well as messy controversies in philosophy and Christian theology, and Ruse does not shy away from evolution’s softest spots, noting honestly for instance that the theory has a long way to go before it can fully explain the origin of life. With such thematic diversity, the depth of content had to be limited, and some chapters accomplish this better than others.

The best, such as the chapter on famous instances of real and alleged fraud in evolutionary biology, hone in on a few representative cases (the Piltdown Man, peppered moths in industrial Britain) and use these detailed examples to illustrate the broader contours of the debate. The book becomes less convincing when it tackles huge topics like race and religion, for here one gets the sense that Ruse is only skimming along the surface of much deeper controversies.

For all its breadth, Darwinism and its discontents remains strikingly narrow when it comes to defining Darwinism itself, which the book limits to the idea of “natural selection as the chief causal process behind all organisms.” After the publication of Origin of species, notes Ruse, “Darwin’s legacy split into two,” one branch being a “real science of evolution” and the other “a secular religion.” The book defends only that first branch, which did not actually become viable until “after about 1930, when the population geneticists brought Mendelian genetics into the picture.” In this sense, a better title for the work might have been Neo-Darwinism and its discontents, for Ruse is not so much interested here in historical Darwinism, a large-scale cultural phenomenon of the Victorian era, as he is in those specific elements of Darwin’s work that have become incorporated into the central dogma of modern biology. Those who might have considered themselves Darwinists without much caring about selection (the vitalist Henri Bergson, for instance, who makes a brief appearance in the book) receive short shrift, while many of the alleged critics of Darwinism, like Stephen Jay Gould or Richard Lewontin, are without a doubt thinkers within the broader Darwinian tradition, even if they might criticize certain aspects of modern neo-Darwinism. Some religious fundamentalists employ the threat of a looming secular atheist menace to attack less doctrinaire sects, arguing that only a rigid adherence to foundational beliefs can save Christianity from its enemies; with so many vocal external foes today, let’s hope that those within the Darwinian tradition don’t succumb to that same temptation.

Theodore Varno

Laura J. Snyder has reconsidered and reinterpreted the mid-19th century debates between William Whewell and John Stuart Mill. She has also placed these debates in the social and intellectual context of their times. The core of the book consists of careful analyses of the philosophical positions of the two protagonists,
with special attention to their theories of induction. We are used to thinking of Whewell as a conservative idealist and Mill as a liberal empiricist, and so they remain in Snyder’s view; but her careful analysis reveals an interesting twist. Whewell argued against the rigid distinction between truths that could be discovered, in principle, through the use of reason, and truths that must be discovered via empirical research. Instead, he held that empirical research was needed in order to clarify concepts, and that truths could not be discovered via reason alone until the relevant concepts were clarified. In consequence, it takes empirical research to reveal the character of analytic truths. It’s possible—in theory—to deduce laws of nature from first principles, but only after empirical research has discovered the concepts to be related. But Snyder’s twist is a double one. While Whewell becomes an idealist who needs empirical research to realize his first principles, Mill becomes an empiricist dedicated to understanding research on the basis of deduced principles of scientific method, and not on the basis of induction over the history of scientific discovery.

Snyder’s great strength is in elaborating and refining our understanding of Whewell, but she does us an additional important service by situating the technical debates between Mill and Whewell in their political and social circumstances. Much of the philosophy of science debate between the two was motivated by the idea that sound thinking would lead to good social policy, and conversely. Thus, assuring the philosophical foundations of understanding (and of discovery in particular) was important not only to philosophers and scientific researchers, but to many other institutions of Victorian society as well. Especially as sound thinking about political economy is important to almost every public policy, the philosophical debates are seen to be part of a much broader set of debates over institutional reform. Snyder’s book then, is a strong contribution not only to a better understanding of 19th-century British philosophy of science, but of the intellectual foundations of that broader institutional reform as well.

Elihu Gerson


A previous history of the Jet Propulsion Laboratory through 1976 has been written by Clayton R. Koppes: *JPL and the American space program: A history of the Jet Propulsion Laboratory* (New Haven: Yale University Press, 1982). Westwick takes up the story after the transition from an army rocket lab to the lead NASA lab for planetary exploration, operated under contract by the California Institute of Technology. The replacement of longtime director William Pickering, a lessening of America’s commitment to space exploration in the post-Apollo era, and JPL’s diversification into energy research all took place in 1976. In 1982 further financial tightening encouraged a renewal of JPL’s military ties and brought in a new director. The dissolution of the Soviet Union and the end of the cold war further lessened financial support for planetary exploration and ushered in another new director, in 1991, who tried to change the lab’s culture to faster-better-cheaper.
Westwick’s title, *Into the black*, hints at some of the broad historical themes he addresses. JPL helped develop systems engineering to produce more reliable spacecraft which, hurtled out of our blue atmosphere into black space, were inaccessible for repair should anything go wrong. “Black” also refers to secret military programs, and their interaction with civilian programs at JPL. Furthermore, “black” can be understood in an economic sense, with the increasing hope, after the military and political competition of the space race faded, that America’s space program might be justified by its help in keeping the nation’s economy strong. Furthermore, JPL’s trend away from being an academic research lab toward being a more tightly regulated industrial contractor, might appear to some observers as a black trend in JPL’s history, as was the earlier remilitarization.

Westwick raises and explores an impressive number of issues, with impressively thorough references to publications and archival material. He even touches on wide ranging topics such as the effect of closer military ties, and the resulting security clearance problems for homosexual employees at JPL. Many professionals will find this book useful for their own research, but unfortunately, the eight-page index cannot cover the full range of topics. More casual readers will enjoy this well-written history full of telling and amusing anecdotes. One such story is the musical recordings on the Voyager sent to the outer solar system and beyond, which inspired a television skit in which aliens asked for more Chuck Berry. Above all, the thoughtful concluding chapter can assist a scientifically and technologically literate voting citizenry to make better choices as to whether JPL’s next $30 billion (in constant 1999 dollars), and much more money for other government programs, will be invested wisely or wasted.

Norriss Hetherington