

Introduction to the New Paperback Edition

HISTORIANS are better than their theories, Charles Gillispie would often say, instancing, perhaps, Elie Halévy's thesis that Methodism had immunized England against revolutionary Jacobinism. Gillispie so admired this French historian of the English people that, acting on a suggestion of his graduate advisor, he published an essay on Halévy in 1950, one year in advance of his first book, *Genesis and Geology*. The "ultimate triumph of historical method," he wrote, is "to find a meaning which gives significance and unity to one's work and which can be modified out of the work itself. Whether an interpretative hypothesis is 'true' or not is less important than whether it is honestly come by and fruitful." The author of *The Edge of Objectivity* never put scare quotes around scientific *truth*. History was for him more forgiving and more personal. He had majored in chemistry during the Depression, he said, as a matter of "duty," for the sake of a career. "History was my joy, however." While insisting on thorough research and close attention to sources, he recognized in history a need for interpretation and emphasis that science seemed to disallow. As a writer, Charles Gillispie never hid behind his subject matter.¹

He and Thomas Kuhn were colleagues at Princeton from about 1963 to 1979. He recalled later that they saw eye to eye on all the academic as well as "human" and "practical" matters as-

¹ Charles Coulston Gillispie, "The Work of Elie Halévy: A Critical Appreciation," *Journal of Modern History*, 20 (1950), 232-249, p. 244; Gillispie, "Apologia pro Vita Sua," *Isis*, 90 (1999), Supplement, S84-S94, p. S84. See also Gillispie, "A Professional Life in the History of Science," in Gillispie, *Essays and Reviews in History and History of Science* (Philadelphia: American Philosophical Society, 2004), ix-xix. For a full bibliography, see Jed Z. Buchwald, ed., *A Master of Scientific History* (New York: Springer, 2012), 3-13.

sociated with managing a teaching program. There was just one matter on which they disagreed, he said, of little consequence for their personal or collegial relations. It concerned merely “the fundamental nature of science.”² That disagreement is most palpable in the books they wrote just before Kuhn joined him in the new Princeton program in History and Philosophy of Science. Gillispie framed his *Edge of Objectivity* as a positivist narrative of the ascent of the sciences in sequence to objectivity: first, mechanics or physics, then chemistry, then biology. That book impressed general readers, as well as scholars and scientists from a range of disciplines, and served students and their teachers as a (dauntingly) high-level introduction to the history of scientific ideas. Kuhn’s *Structure of Scientific Revolutions* (1962), one of the most influential academic books of the twentieth century, made a conscious break with positivism. He said that scientists accept “paradigms” almost as dogma, and that the evidence can never be sufficient to require a transition to a new one. Kuhn never wrapped up an episode by declaring, as Gillispie does, that Diderot’s or Goethe’s position was wrong for science. But then he did not emphasize such characters at all.

Gillispie, who enjoyed such provocations, sometimes exaggerated his intellectual differences with Kuhn. They had begun discussing intellectual possibilities for history of science as a field of knowledge in 1946, when they were Harvard graduate students. Both favored a naturalistic account of science growing outward from insecure roots rather than being drawn to a telos of irresistible truth. Both found essential inspiration in the writings of the philosophical historian Alexandre Koyré, whose deep engagement with classic scientific texts also inspired many of their colleagues. In the 1970s, such work began to be criticized as “internalist,” which was not quite accurate, since Koyré and his admirers emphasized intellectual themes that linked natural science to wide philosophical traditions, notably

² Gillispie, “Apologia,” p. S90.

Platonism. By 1980, both Gillispie and Kuhn worried that the new generation of scholars was not engaging seriously with the content of the science. They shared, finally, a degree of idealism, insisting on the need of science to achieve conceptual coherence before empirical results could have much definite meaning. *The Edge of Objectivity* stresses this point from the very first page, where Galileo is quoted giving a correct formula for falling bodies on the basis of incorrect premises that even contradict his law. When, finally, Galileo understood how to grasp motion with mathematics, it was a true “mutation of ideas.”³

In later work, Gillispie emphasized the interactions of science with the state and its technologies. Inspired by his participation as preceptor in a lecture course by his senior colleague R. R. Palmer, he launched a research project on science and the French Revolution, which by 1960 was well underway. The scope and density of archival research for that project, culminating in two large volumes on *Science and Polity in France*, remain unmatched in the history of science.⁴ By then he regarded his focus on ideas as much too narrow, and he says so in the new introduction, written in 1990. He wrote the original text of *The Edge of Objectivity* from printed materials, growing out of an undergraduate course that he first taught in 1956. His topics were already familiar ones, even if real historical scholarship was lacking for many of them. While a few reviewers delighted, as academic reviewers often do, in pointing out little lapses, a fair-minded scholar will be impressed, even now, by his knowledge of the sources for three centuries of science. His prose, which is nothing if not brilliant, does not merely render the science comprehensible, but evokes the activities, ambitions, and achievements of these scientific men (there are no women) in arresting images.

³ Gillispie, “Thomas S. Kuhn: The Nature of Science,” *Science* (14 Dec. 1962), reprinted in Gillispie, *Essays and Reviews*, 341–349.

⁴ *Science and Polity in France at the End of the Old Regime* (Princeton: Princeton University Press, 1980); *Science and Polity in France: The Revolutionary and Napoleonic Years* (Princeton: Princeton University Press, 2004).

The book is organized by the forward leaps of the objectivizing edge, from Galileo's mechanics to Newton's physics, then the chemistry of Priestley, Lavoisier, and Dalton and the biology of Darwin and Mendel. Gillispie finishes with a survey of developments in nineteenth-century physics that set the stage for yet another leap into mathematical abstraction, Einstein's relativity. As an interpretive hypothesis, the relentless advance of objectivity provides a plot line, rudimentary but comprehensive, connecting developments from diverse fields of science. Was that all he asked of it? Clearly not. Since science is about things rather than values, he proposed, the history of science may extend the definiteness of its subject even to slippery and elusive concepts such as romanticism. He exposed Locke's psychology as resting on a basic fallacy, the aspiration to analyze objectively what is only experienced subjectively, and boldly condemned the whole project of social science as vitiated by the characteristic determination of its practitioners to do good. He even offered retrospective counsel to biologists, who, with the benefit of proper history, might have heeded the lesson of Dalton's atomic chemistry and seized on Mendel's genetic atomism at the first opportunity.⁵

His insistence on the absolute neutrality of objective science might in other hands lead to a narrative without character. However, Gillispie's enchantment with the backgrounds, ambitions, and personalities of his protagonists shines through everywhere. The "cruel edge of objectivity," in real life, wears many masks and is shaped by differences in the manners and methods of the scientists. He credits the first big step in the advance of objectivity, the mathematization of motion, partly to Kepler, whom Arthur Koestler (in *The Sleepwalkers*) had depicted as a mystic hero. Gillispie identified the spirit of true science with Galileo's "Latin genius," the "clear light of Italian classicism," which Koestler demonized. Koestler, to Gillispie, was a

⁵ Gillispie, *Edge*, pp. 164, 154, 335. He reaffirmed its basic thesis in 2004 in "l'Envoi," *Essays and Reviews*, 405–411, pp. 409–411.

literary figure who (therefore) utterly misunderstood science, yet Kepler's Germanic mysticism, which Koestler admired, is depicted most engagingly in *The Edge of Objectivity* as well. Gillispie's most memorable *pas de deux* of scientific advance juxtaposes the cool, closed Lavoisier—competent, organized, and precise, but too inflexible to adjust to surprises—with the modest, confiding, spontaneous Priestley. Together they created a new chemistry of gases and brought this science to the point of quantification, enshrined in Lavoisier's textbook. Back in the north of England, John Dalton with his atoms achieved the denouement, objective chemistry.

Stories like these do more than spice up a narrative; they represent science as multifarious and perhaps even as dependent on human heterogeneity, within reason. Gillispie put particular emphasis on national differences, and seems sometimes to essentialize them. He also insisted on science as distinctively European. In one notorious passage, he expresses anxiety about the consequences when nations outside "our" culture acquire its technological fruits, as they must. Much of this is difficult to square with the image of science as strict, unyielding, and irretrievably amoral. Just what, if not some form of moral commitment, would "European" science in the hands of the Chinese or Egyptians be missing? He does not say. But he does identify the danger with a specific technological device: the bomb.

From the standpoint of the third-millennium science, which, so far, has been obsessed with genetics and genomics, it is not so obvious that a book like *The Edge of Objectivity* should start and end with physics. In the wake of Hiroshima and Nagasaki, at the height of the Cold War, state-sponsored military applications loomed much larger than biomedical ones. The security of the free world seemed to depend on science, yet science must be free rather than a slave to military ambitions. While schoolchildren now received lessons in "scientific method," Gillispie was too clear-headed to suppose that such teaching could give access to the serious work of science. Historical study appeared more

promising for this purpose. It would not make citizens into scientists, but it would give them an appreciation of the sources and of the complex thought processes of science. Only the ignorant could suppose that science reduces to commonsense knowledge and empirical study. That, he argues, was Bacon's idea, and it was vulgar.

The opinions of historians still differ on Bacon's importance for science. It brings us, however, to what is truly original, even brilliant, in this book. In parallel with this history of the advance of mathematical reason, Gillispie offers here a history of anti-science. He condemned it unequivocally, but he also was entranced, and the reader will find here a fresh and original history of resistance to science, a warfare not between science and theology, but of neutral objectivity against moralized nature. The fluctuating tensions between science and Christianity he regarded as superficial and transitory, for the rock of religion does not depend on nature. It was, instead, atheists who could not tolerate the "meaningless chance which operates under the name of natural selection."⁶ Objective science, he declares, reduces becoming to being. It chooses atomism over a swirling continuum and does not recoil from the reality of chance. Neither does it protest the alienation of the scientist from nature. Romantic science rejected physics, positioning biology as fundamental and building this biology from a necessitarian organicism. This is the ever-changing nature described by Heraclitus, whose flows are immanent, spontaneous, and elude explanation. Gillispie calls attention to its sexualized language, such as the erotic tension and release in Goethe's description of plants.

He took up the topic of anti-science initially in relation to France in the era of its Revolution. In 1956 and 1959, he published strikingly new interpretations of Lamarck, and then of the articles on chemistry in Diderot's *Encyclopédie*. He set up Diderot's dislike of mathematics as a model for the hostility toward

⁶ Gillispie, *Edge*, p. 351.

the Paris Academy of Sciences that broke out as the Old Regime crumbled. In the paper on Lamarck he showed that the inheritance of acquired characters had only a superficial role in Lamarckian evolution, which really came down to chemistry and to spontaneous processes of organic development. *The Edge of Objectivity* deals especially harshly with Goethe's scientific pretensions, and later explains some prominent German evolutionists of the late nineteenth century as romantic opponents of objectivity, and in no way Darwinians. He identified Stoic *pneuma*, with its focus on activity rather than stable, atomic matter, as prototype of these romantic doctrines.⁷

Even as he condemned their evocation of a living, inchoate, sexualized nature, his dazzling prose brought them to life. These passages, like the chapter on Marat and Mesmer in *Science and Polity*, are irresistible. Whether or not we choose to follow him in dismissing Diderot, Lamarck, and Goethe as anti-scientific, he succeeded in demonstrating their radical dissent from the scientific traditions recognized by a present-minded history. Yet their science was more than unadorned ideology. It had its own empirical basis, as he shows, and often was congruent with craft knowledge.⁸ He also challenged elite appropriations of scientific doctrine. While he insisted on the centrality of science to Western civilization, he speaks here of high-minded ambitions to unify the two cultures as fatuous. Objective science, in his book, stands utterly apart from human values and feelings. In a memorable digression, he quotes an argument from "a book on conservatism" that "diffusion of power is the characteristic of organic life" and a safeguard against "efficient despotism." He must have been holding a copy from the Princeton Library, for he next remarks that this passage had been "appreciatively

⁷ On the stoics, see his review of Schmucl Sambursky, *A Physicist Looks at Greek Science* (1956) in *American Scientist* (1958), reprinted in Gillispie, *Essays and Reviews*, 316–331. See also reprints there of his papers on Lamarck and on the chemistry in the *Encyclopédie*, pp. 47–62 and 107–142

⁸ See especially *Science and Polity in France (The End of the Old Regime)*, 290–330.

underlined by a succession of student readers, fortunate young men of the American elite.... [I]t is almost alarming to think for a moment of the vast structures of reasoning about the state and society which depend upon substituting the metaphor of organism for atomism and mechanism.” We see, then, what “deep interests and deep feelings,” from romantic conservatism to socialism, have been bound up with the “metaphor of organism.” He called it a false crutch for politics, and “the wrong view for science.”⁹

The Edge of Objectivity provides a passionate defense of cool, abstract, objective science, detached from human meanings. Yet the plot line depends on such meanings. We cannot forget the author’s own ultimate choice. Sometime in 1941, after a stint of graduate work in chemical engineering at MIT, he decided “it would be better to do what was pleasing,” and enrolled at Harvard as a graduate student in history. That much he put down in writing. There is a more novelistic version which he communicated now and again to audiences of historians:¹⁰ Standing on a bridge over the Charles River, tortured by doubts, the hero at last flings his slide rule (for this is not Werther) into the watery deep, sealing a decision for history that four years of obligatory military service would not overturn. While he did not at all forsake the austere objectivity of science, he converted it willy-nilly into an interpretive hypothesis of history.

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⁹ Gillispie, *Edge*, pp. 200–201; R. J. White, *The Conservative Tradition* (London: N. Kaye, 1950), pp. 8–9. Thanks to Emily Kern for examining the Firestone Library copy of this book, whose underlining differs from what Gillispie describes. However, the book is marked as copy 2, and there is now no copy 1.

¹⁰ Gillispie, “Apologia,” p. S84. He told this story in his 1999 distinguished lecture in Pittsburgh to the History of Science Society.