History of Science at the University of Wisconsin

*By Victor L. Hilts**

"SOONER OR LATER, SCIENCE WILL HAVE TO BE ABSORBED, the educated man will have to be made a reader, a connoisseur, even a judge of science." So wrote Jacques Barzun in the summer of 1947; the way to achieve this end, he argued, was through the study of history of science. Yet, he noted, "only one university—Wisconsin—offers anything adequate to this massive cultural responsibility."[1]

It was no accident that Barzun was familiar with the teaching of history of science at the University of Wisconsin. Two months before the appearance of his comments in *Harper's,* one of his colleagues at Columbia University, Marshall Clagett, had accepted an invitation to come to Madison to help reactivate Wisconsin's Department of History of Science. The department Clagett was to join had been established in 1941 as the first separate history of science department at an American university, but had been inactive during the war years.

This essay reviews the background to the establishment of Wisconsin's History of Science Department and, more briefly, some of the experience of that department since its establishment. To a significant degree the pattern for the development of history of science at Wisconsin from 1947 to the present was determined by actions taken at the university during 1946–1947. Interest in history of science at Wisconsin during those two years was part of a widespread awareness of the subject immediately after World War II. However, the university's institutional commitment to history of science can only be understood within the context of the history of the university itself.[2]

WILLIAM SNOW MILLER AND EDWARD KREMERS

Unlike Harvard, which was favored with the presence of George Sarton, no individual at the University of Wisconsin can be considered the single major architect of the Wisconsin program in history of science. Marshall Clagett, more

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[1] Jacques Barzun, "New Books. Consumers' Goods: Science and Letters," *Harper's,* July 1947, end pages.

[2] Some material relating to the History of Science Department is in the University of Wisconsin—Madison Archives and the State Historical Society of Wisconsin (SHSW). The History of Science Department also retains files concerning its own early history. I am indebted to Robert Stauffer and to Glenn Sonnedecker for their help in locating material. I have also benefited from Sonnedecker's unpublished "The Wisconsin Programs in the History of Science and the Health Professions," delivered at the 1977 meeting of the American Association of the History of Medicine.

than anyone else, was to be responsible for the initial success at the university of graduate studies in the discipline, but events preceding Clagett's arrival had already created a climate favorable to history of science. Among its earliest advocates were two Wisconsin scientists whose avocational interest in the subject can be traced back to the turn of the twentieth century—William Snow Miller (1859–1939) and Edward Kremers (1864–1941). Miller inspired enthusiasm for medical history among students and faculty of the Medical School, whereas Kremers, who was director of the Pharmacy School, made Madison a leading center for the history of pharmacy. Kremers was also responsible for introducing the name of George Sarton at the university in the 1930s.

Having been uprooted by the dispersal of the graduate faculty of Clark University, William Snow Miller arrived in Madison in 1893 as a specialist on the anatomy of the lung. Sixteen years later he commenced a medical history seminar that usually met during the evening at his home. Participants were attracted both by Miller's respect for history and by his magnificent library of six thousand volumes in history of medicine and anatomy, which included such treasures as early editions of Vesalius's *De humani corporis fabrica*. The seminar carried no course credit, but formal papers were delivered by advanced medical students and faculty. Although Miller's own historical gleanings were somewhat provincial (in later years much of his energy was spent creating local awareness of William Beaumont's connections with the state of Wisconsin), before his retirement in 1929 no fewer than thirty-eight published papers on the history of medicine owed their origin to the medical history seminar. Among the most avid seminar participants was Chauncey D. Leake, a noted pharmacologist who was to retain a life-long interest in medical history. During the summer session of 1921 Leake himself taught the university's first course on the general history of science—in order, as he later recalled, to introduce "humanistically oriented people" to the "drama and emotional thrill of science." Another regular seminar participant was William S. Middleton, destined to become dean of the Medical School and in that capacity to help establish a chair for medical history at the university. The seminar survived Miller's retirement and was continued by colleagues under the name William Snow Miller Seminar after Miller's death in 1939.[3]

Even before William Snow Miller began captivating medical students and faculty with vespertine discussions of medical history, Edward Kremers was generating enthusiasm for history of science among fellow pharmacists. Kremers also liked to collect rare books and other old things relating to the early days of his profession, but his motives for the study of history were more complex than Miller's. As director of Wisconsin's Pharmacy School, Kremers dedicated himself to reforming the pharmaceutical profession by making pharmacists rise above their pill making and think like scientists. Kremers believed that history

[3] Chauncey D. Leake, "Reply" to letter of John Parascandola, *Isis*, 1973, *64*:385; William S. Middleton, "Doctor William Snow Miller and His Seminar," *Bulletin of the History of Medicine*, 1940, *7*:1067–1072; Ch. H. Bunting, "William Snow Miller, 1958–1939," *Science*, 1940, *91*:182–183; William Snow Miller, "A Plea for a Memorial to Dr. William Beaumont" (Madison, Wis., 1931?). In 1952 Leake wrote (*Isis*, 1952, *43*:368) that his course "was offered as a result of the stimulus afforded by the efforts of Dr. George Sarton, and the attempt was made to develop the course from the standpoint of bridging the gap between the sciences and the humanities." Leake's 1921 course met 5 days a week for 6 weeks but carried no credit.

of pharmacy could contribute to this reform. Pharmacists, thought Kremers, could learn of the dignity of their profession and of its contributions to culture through the study of history. They could also learn to think like scientists. "A scientific mental make up is acquired," Kremers wrote in 1902, "not by merely learning what is the current truth in the sciences today, but by becoming a thinker in science. This attitude can be strengthened . . . by the study of the evolution of science."[4]

Kremers's faith in history was rooted in his own experience. About 1880 he apprenticed himself to the German-educated proprietor of a Milwaukee *Apotheke* who in turn inspired his apprentice with stories concerning the glories of German science. Kremers did not forget history of science after he began his university studies. After completing his apprenticeship, Kremers enrolled at Wisconsin for undergraduate work and then went to Germany, where he received a Ph.D. in chemistry in 1890 from Göttingen. In Germany Kremers was particularly impressed by the historical insights of Friedrich Kekulé. Kekulé, wrote Kremers, augmented his chemical lectures with historical material that showed "how chemical progress has modified not only philosophic thought but how it had exerted its influences on all classes of human society." While in Germany, Kremers also heard about a new kind of history, *Kulturgeschichte,* in which history of science, he began to think, should play a larger role.[5]

Kremers lost no time introducing historical topics into his own teaching. Immediately after receiving his Ph.D., he returned to Wisconsin as an instructor in pharmacy. Soon he was director of the Pharmacy School. As early as 1890–1891 Kremers indicated in the university catalogue that his course on pharmaceutical chemistry contained a historical component. Two years later he wrote that "the professional student should have at least a fair knowledge of the history of his profession."[6] Kremers's first exclusively historical courses were a semimonthly seminar on the history of pharmacy inaugurated in fall 1906 and another seminar on the history of chemistry begun in 1907–1908. His knowledge of both fields and his fondness for emphasizing the connections—historical and contemporary—between pharmacy and chemistry made it natural that he should teach the history of both. Both courses provided academic credit, and both developed a substantial clientele: History of Pharmacy averaged about thirty-five students per year between 1906 and Kremers's retirement in 1935, while History of Chemistry enrolled almost fifty students when last delivered by Kremers in 1919–1920.[7]

[4] Edward Kremers, "The State Universities and Pharmaceutical Education," delivered at the University of Michigan School of Pharmacy, 1902, p. 12, Kremers papers, SHSW, Box 12; see also George Urdang, "Edward Kremers (1865–1941), Reformer of American Pharmaceutical Education," *Transactions of the Wisconsin Academy of Sciences, Arts and Letters,* 1945, *36*:111–135; Glenn Sonnedecker, "Writing the History of Pharmacy in the U.S.A.," *Pharmacy in History,* 1978, *20*:3–16. A particularly visible product of Kremers's historical collecting was the Historical Drug Store installed in the Museum of the State History Society of Wisconsin in 1913. Kremers papers are deposited in the Kremers Reference Files, F. B. Power Pharmaceutical Library (PPL), University of Wisconsin—Madison, as well as in the State Historical Society of Wisconsin.

[5] Edward Kremers, "Apprenticeship," pp. 6–10, Kremers papers, SHSW, Box 9; Kremers, "Louis Lotz," *The Badger Pharmacist,* February 1936, pp. 1–5; Kremers, "The Historical Element in the Teaching of the Natural Sciences," read at Conference of Association of High School Principals, 30 May 1902, p. 6, Kremers papers, SHSW, Box 12.

[6] See Urdang, "Edward Kremers," pp. 120, 122.

[7] Stanley Becker, "Instruction in History of Pharmacy at the University of Wisconsin," 1963, and

Although Edward Kremers's zeal for history of science centered on pharmacy and antedated George Sarton's crusade for the subject, the two had a similar understanding of history. Kremers's conviction that history of pharmacy would illustrate the cultural significance of his own profession was but a particularized version of Sarton's claims for the general history of science. Moreover, Kremers had a genuinely humanistic—even literary—bent that enabled him to transcend the pharmaceutical focus. Thus in 1902 Kremers wrote, much in the Sartonian vein, but in this case with reference to *Kulturgeschichte:*

> It is a significant fact that in the treatises on civilization the natural sciences until recently have played and even now play such an insignificant role. The explanation for this striking fact is not far to seek. Natural scientists as a class have not awakened to the importance of the history of their own sciences, less to the charm that attaches to the study of the influences of the development of their sciences on the progress of civilization. The laboratory method has conquered history, but the historical method has not yet conquered the natural sciences.[8]

Not surprisingly, given these views, Kremers was one of the first at Wisconsin to appreciate George Sarton's promotion of the history of science. An early member of the History of Science Society, Kremers in the 1930s became enthusiastic about creating a local Madison section of the Society. The secretary of the Baltimore-Washington section of the Society had written in *Science:* "It is by the organization of local chapters which will meet at frequent intervals during the year that the real influence of the History of Science Society will begin to assert itself." Kremers accordingly requested names of society members at the University of Wisconsin, but the result was disappointing: at the time only two resided "within a radius of fifty miles of Madison"—Kremers himself and the electrical engineer Edward Bennett. Kremers's enthusiasm revived, however, when in 1935 the society's officers wrote urging that efforts be made to improve the society's finances by enlarging its membership.[9]

A few days after receiving this letter, Kremers invited university faculty interested in history of science to meet at his home on the evening of 18 July 1935, "for the purpose of discussing the possible organization of a Wisconsin branch of the History of Science Society." Seventeen faculty members responded, including two chemists, two botanists, an engineer, a philosopher of science, a Hispanist, a historian, and Kremers's own successor in Pharmacy, Arthur H. Uhl.[10] Several of the seventeen were leading faculty figures and a few

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Becker, "Instruction in the History of Chemistry at the University of Wisconsin," 1963; Hist. Sci. Dept. files. Ironically, the actual impetus for establishing History of Chemistry came not from Kremers himself but from the Chemistry Department, of which Kremers was a member. When Kremers was on leave in 1907, the Chemistry Department underwent a reorganization that Kremers believed resulted in other faculty members appropriating the most important courses while he was relegated to History of Chemistry. Kremers went on leave again in 1920, and History of Chemistry was assignd to the chemist Louis Kahlenberg, who refused to relinquish the course to its creator upon his return. Edward Kremers, "Louis Kahlenberg," pp. 8–9, 14–15, Kremers papers, SHSW, Box 17.

[8] Kremers, "The Historical Element," p. 2.

[9] Morris C. Leikind, "The History of Science Movement in Washington, D.C.," *Science,* 1934, *79*:209; F. E. Brasch to E. Kremers, 22 Mar. 1934, C. A. Browne and F. E. Brasch to Kremers, 2 July 1935, Kremers Reference Files, PPL.

[10] Kremers to the chairmen of the science departments, University of Wisconsin, 11 July 1935, Kremers Reference Files, PPL. The seventeen were Antonio G. Solalinde (Spanish); Robert L. Rey-

had considerable prior interest in history of science—notably the food chemist Henry A. Schuette and the biochemist Karl Paul Link. The historian present was the young medievalist Robert L. Reynolds. Reynolds was later to play key roles in the department's history, but in 1935 he wrote to Kremers modestly that he "came to learn from the scientists." During the evening Kremers displayed copies of *Isis* as well as volumes of George Sarton's *Introduction to the History of Science*. No action was taken to form a local Madison section of the History of Science Society, but a committee was appointed to plan five or six meetings on the history of science for the following year.[11]

It was also decided at the gathering to invite George Sarton to give a lecture at Madison. Kremers knew that bringing Sarton to Madison would publicize both history of science and the History of Science Society. He probably also hoped that Sarton would discuss the new Harvard Ph.D. program in history of science, about which Kremers also sought information directly from Harvard's President James B. Conant in February 1936.[12] Since Sarton was unavailable by the time lecture funds could be arranged, however, an invitation to speak on history of science was extended instead to the philosopher Charles W. Morris of the University of Chicago. Morris belonged to the unity-of-science movement and at a recent History of Science Society annual meeting had described Chicago's experiment in teaching history of science by the "co-operative method." Scheduled for 23 March 1936, Morris's lecture was billed as "the first step in stimulating interest in the history of science on the University of Wisconsin campus." At least in part, Morris lived up to his billing. Asking "whether science should provide the cultural center of the University as opposed to literary humanism," Morris maintained that it should—as soon as science itself had become more self-conscious and critical by the development of its methodology, psychology, sociology, and history.[13]

The lecture arranged for Morris was not really the "first step" in creating interest in history of science in Madison, but at least it was a step in the right direction. Moreover, events a few years later would prove that Kremers's efforts to publicize history of science were not to go unrewarded. Although Kremers, by 1936 past retirement age, could do little more proselytizing for the general history of science, his activities in history of pharmacy were not yet finished. His most important historical publication before retirement had been an edition of an early pharmacopeia, and only one of his more than fifty doctoral students had written a dissertation on the history of pharmacy.[14] But Kremers had long

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nolds (History); Arthur H. Uhl (Pharmacy); Henry A. Schuette (Chemistry); Arthur Beatty (English); Homer Adkins (Chemistry); Karl Paul Link (Biochemistry); Edward Gilbert (Botany); Albert G. Ramsperger (Philosophy); Edward Bennett (Electrical Engineering); Edward A. Ross (Sociology); Norman P. Neal (Agronomy); Leon J. Cole (Genetics); J. Alfred Hall (Forest Products Laboratory); George S. Bryan (Botany); Edward R. Maurer (Mechanics); Edward Kremers (Pharmacy).

[11] R. L. Reynolds to Kremers, 16 July 1935, Kremers to F. E. Brasch, 23 July 1935, Kremers Reference Files, PPL.

[12] Stephen H. Stackpole to Kremers, 17 Feb. 1936, Kremers Reference Files, PPL.

[13] "Science History Lecture Booked," [Madison] *Wisconsin State Journal*, 17 Mar. 1936; "Tells of Clash Between Science and Humanities," *ibid.*, 25 Mar. 1936.

[14] Sister Mary Francis Xavier, "The Statutes of the Guild of Physicians, Apothecaries, and Merchants in Florence, 1313–1316," 1936; see Sonnedecker, "Writing the History of Pharmacy in the U.S.A." (cit. n. 4), p. 8 and n. 10.

contemplated producing a comprehensive historical survey of pharmacy that would embrace both European and American developments. Spurred on by his publisher, J. B. Lippincott, Kremers in 1938 invited to Madison a refugee German pharmaceutical historian, George Urdang, to provide assistance with the great work. Urdang knew more about European pharmaceutical developments than did Kremers, was a full-time professional historian, and was fluent in both German and English. Kremers and Urdang's *History of Pharmacy* at last made its appearance in 1940, only a year before Kremers died in July 1941.[15]

THE FARRINGTON DANIELS CURRICULUM COMMITTEE (1939–1940)

Among those gathered at the Kremers home in July 1935 to discuss history of science, none could don Edward Kremers's mantle as a missionary for the field. Yet only six years later history of science had been introduced into the course catalogue of the University of Wisconsin and a department of history of science had been established. These swift developments had less to do with the emergence of history of science as a scholarly profession than with educational issues confronting the university in the 1930s.

With its financial resources depleted during the depression, Wisconsin, like many other public universities, faced the task of educating growing numbers of students. Some faculty members at Wisconsin believed that undergraduate enrollment was unduly swollen by the large number of freshmen who had no intention of remaining for a degree or, for whatever reason, stayed only a year or two. These faculty argued that students whose prospects of completing a degree were small should be denied admission, but the university's president, Clarence A. Dykstra, resisted this idea. A professor of political science and until 1937 the city manager of Cincinnati, Dykstra was a forceful administrator who believed that university education should be open to all classes of students and that the principal task of a public university was to educate for "citizenship." An open-door policy, however, implied increased attention to general education at a time when many faculty were already complaining that teaching was encroaching upon research. The situation motivated the Madison Teachers Union in the spring of 1938 to urge formation of a curriculum committee. In April 1939 Dean George Sellery of the College of Letters and Science, with the approval and encouragement of Dykstra, responded by appointing a Committee on Curriculum and Educational Procedures—known after its chairman as the Daniels Committee.[16]

Sellery's choice for chairman of the Curriculum Committee, Farrington Daniels, was politically astute and—for history of science—lucky. Daniels, who had received his Ph.D. in 1914 for electrochemical studies completed in the laboratory of Theodore W. Richards at Harvard, was one of Wisconsin's most distinguished chemists and a man sensitive to broad issues and educational needs.

[15] Donna S. Taylor, interview of Arthur H. Uhl, 1974, p. 9, University Archives; Edward Kremers and George Urdang, *History of Pharmacy* (Philadelphia: Lippincott, 1940). There have been four editions of this work; the 3rd (1963) and 4th (1976) were edited by Glenn Sonnedecker.

[16] "Dykstra, Garrison, Daniels address Teachers Union," *Madison Teacher* (published by locals 223 and 35 of the American Federation of Teachers), 2 June 1938, *1*(4). Materials on the Daniels Committee are in the Farrington Daniels papers, University Archives.

He was well aware of the factors that necessitated formation of his committee, and in May 1938 he had himself endorsed the call of the Madison Teachers Union for a review of the curriculum. It was not in Daniels alone, however, that the Curriculum Committee membership proved lucky for the history of science. According to Daniels's own account, the two most active members of his committee were the historian Robert Reynolds and the mycologist Edward M. Gilbert—both of whom had been present four years previously at Edward Kremers's home when discussion had focused upon the writings of George Sarton. Given its membership, it was no surprise that the committee's attention would turn to history of science.[17]

The Daniels Committee met during the summer and fall of 1939 and had developed most of its recommendations by that Thanksgiving. The committee reported to the faculty in March 1940, noting that "specialization versus breadth" and increased enrollment at a time of reduced resources were the two issues shaping its deliberations. Its recommendations—all given faculty approval—included three new interdisciplinary courses: one for freshmen, one for sophomores, and one for seniors. Each course was to aim at introducing students to some broad aspect of the modern world, and for the sophmore year the committee recommended a course entitled "History and Significance of Science," to be administered by a committee appointed by Dean Sellery.[18]

A course was not a department and a course on the history and significance of science was not necessarily a course on the history of science. What did the Daniels Committee have in mind? It is clear that Daniels himself did not see the course as exclusively devoted to history of science. In correspondence with Robert Reynolds, Daniels referred to the "significance of science" course, and it would appear from markings on Daniels's personal copy of an early draft of the committee's report that he entertained notions of striking the word *history* from the course title altogether. At one point during the committee's deliberations, when an initial outline of recommendations was being made in preparation for a report to the faculty, the course was described as a "new course in philosophy, appreciation, and history of science," and the content sketchily outlined as "a year course, three credits per semester, no laboratory, [but with] lectures, movies, etc. and reading. To cover physical sciences, life sciences, earth sciences." The description of the course agreed upon in the final version of the Daniels Committee report and approved by the faculty was as follows:

> The Committee suggests that this be a year course presenting in a broad fashion the aims, methods, achievements, and influence of science. The course may be organized first as a semester course and extended to a full year as promptly as possible.

[17] Aaron Ihde, "A Brilliant Career Ends," *Badger Chemist* (May 1973), pp. 3–4, 8; Steven Lowe, "Recollections of a Career in Science and Teaching" (interview with Farrington Daniels), 1972, University Archives, p. 13; Olive Bell Daniels, "Farrington Daniels, Chemist and Prophet of the Solar Age, A Biography," University Archives. Another member of the Daniels Committee with an interest in history of science was the botanist Lowell Noland.

[18] "Revision of Curriculum and Educational Procedures," Faculty Document 591, Mar. 1940, University Archives. In responding to a faculty member's concern about the "quality of the incoming student group," Daniels wrote: "Limitation of enrollment with the exclusion of the poorer students would help to solve many of our problems, but everyone who is in a position to know seems to feel that it just cannot be done in Wisconsin"; Daniels to R. A. Brink, 29 Nov. 1939, University Archives.

> The organization of this course shall be intrusted to a committee appointed by the Dean. The prerequisites shall be sophomore standing, and the course shall carry three credits per semester.[19]

Because of the ambiguity of the title "History and Significance of Science," the actual character of the course depended very much upon whoever was in charge. The Madison Teachers Union queried, "why shouldn't the science divisions be in charge of this course?" Instead, however, its fate lay with Dean George Sellery. Himself a medievalist, Sellery was aware of the attempts made several years earlier to generate enthusiasm for the history of science; indeed he had recently written to Kremers: "I am familiar with Sarton's work and I am very much interested in the subject."[20] Kremers, who was just then engaging in bitter negotiations with Sellery over the matter of Kremers's mandatory retirement, doubted Sellery's sincerity, but the doubts were misplaced. Instead of appointing a committee to oversee the course on "history and significance of science," Sellery immediately began looking for someone to teach it. More important, in October 1940 Sellery's legislative budget request for the next biennium (1941–1943) included an entry for a new Department of History of Science—with a proposed budget of $2,500 per annum earmarked for the salary of a new assistant professor. Sellery did not explain his decision to create a History of Science Department. One may, however, guess at his motivation. "History and Significance of Science" was designed to be an interdisciplinary course, and what better way could there be to ensure that it was not taken over by an existing department than to create a new department?[21]

THE GUERLAC YEARS (1941–1943)

"History and Significance of Science" was first given on an interim basis in the fall of 1940 by the English geneticist and scientific popularizer Lancelot Hogben. Hogben had been lecturing in Norway when Germany invaded that country and, unable to return home directly, traveled eastwards through Asia. He eventually

[19] Daniels to Reynolds (draft, n.d., prob. Nov. 1939); "Report of the Committee on Curriculum and Educational Procedures (As of December 9, 1939)"; "Outline of Report to Faculty"; "Revision of Curriculum and Educational Procedures," Faculty Document 591, p. 2; all in Daniels papers, University Archives. These documents contradict Daniels's later assertion that what "we advocated was a new department of the History of Science. Science had become important, and the history of it was important. We had some people who were working on it here in the faculty, but we felt it should be emphasized even to the extent of making a new, separate department"; Lowe, interview with Daniels, pp. 12–13. Kremers may have proposed a course with the title "history and significance of science" in 1897, but there is no evidence that Kremers had direct contact with the Daniels Committee; *Milwaukee Journal,* 17 Mar. 1940.

[20] "Teachers Union Analyzes Report of University Curriculum Committee," *Madison Teacher,* Feb. 1940, *3*(3):1; George Sellery to Kremers, 30 July 1935, Kremers papers, SHSW.

[21] George Sellery budget papers, University Archives. Sellery was a strong believer in the importance of departments. When President Glenn Frank argued in 1930 that a blending of disciplines made departments obsolete, Sellery defended the departmental system. He later wrote with respect to Frank's views: "Is it not the departments, the very homes or citadels of cognate academic interests, that are basic?" George Sellery, *Some Ferments at Wisconsin, 1901–1947, Memories and Reflections* (Madison: Univ. Wisconsin Press, for the Univ. Wisconsin Library, 1960), p. 53. It is also Henry Guerlac's impression that "in all likelihood it was George Sellery who thought of placing the [history of science] project in a separate department"; Henry Guerlac to Victor Hilts, 19 Nov. 1979.

arrived in Madison, where he was given a temporary appointment teaching the new course as well as a graduate seminar on genetics. Evidently Hogben was a success, because when the fall term was over President Dykstra requested "as a favor" from the University of Aberdeen, where Hogben had a permanent appointment, that Hogben be allowed to complete the academic year at Wisconsin. The answer from Aberdeen, however, was a telegram: "HAVE SPARED HOGBEN ALREADY FOR TEN MONTHS MUST HAVE HIM BACK NOW VERY SORRY INDEED TO REFUSE REQUEST FROM YOU."[22]

Hogben's hurried departure made no real difference in plans for the history of science at Wisconsin. Upon the recommendation of George Sarton, Dean Sellery had already been in contact with Henry Guerlac in spring 1940 regarding Guerlac's coming to Wisconsin to establish a history of science department. Because Guerlac was still completing his dissertation, it was agreed that he would not assume his duties until the fall of 1941. His credentials were, in fact, ideal. After earning two degrees in chemistry from Cornell University, Guerlac had gone to Harvard as a graduate student in chemistry and research assistant to Lawrence J. Henderson at the Harvard Fatigue Laboratory. Two years later he had completed a Harvard M.A. in chemistry and been appointed a junior fellow of the Harvard Society of Fellows. At the Fatigue Laboratory Guerlac did enzyme research, but Henderson, who was himself greatly interested in history of science, kindled his historical instincts by teasing, "You're French. Have you read Claude Bernard? Have you read Lavoisier?" Guerlac hadn't; but he soon did—and exchanged enzymes for history and eventually for history of science. Guerlac took history of science courses with George Sarton and received his Ph.D. in modern European history for a dissertation on wartime science in the Old Regime.[23]

Guerlac arrived in Madison to begin teaching in the fall semester of 1941. Sellery seems to have made no great effort to impress upon him an appreciation of the complex series of events that had led the Daniels Committee to recommend a course on the history and significance of science. Instead, Sellery let Guerlac know that he had come to establish a department of history of science. When Guerlac inquired what kind of courses he should give, Sellery replied noncomittally, "It is a little difficult for me to tell you the courses that an instructor in history and significance of science should give. You ought to be able to answer that question better than I."[24] Given the opportunity, Guerlac called his course simply "Survey of the History of Science." The word *significance* was never again to appear in the course title.

Although Sellery gave Guerlac a great deal of latitude in constructing his course, he knew the weaknesses of young historians and insisted that it be given

[22] "Prof. Hogben Called Back to Scotland," *Wisconsin Alumnus*, 1941, *42*:137; telegram from G. H. Fyfe to C. Dykstra, 15 Jan. 1941, Dykstra papers, University Archives.

[23] Sellery to Henry Guerlac, 23 Apr. 1940, Sellery papers, University Archives; conversation with Henry Guerlac, Jan. 1980; "Henry Guerlac," in Crane Brinton, ed., *The Society of Fellows* (Cambridge, Mass.: Society of Fellows of Harvard University [distributed by Harvard Univ. Press], 1959), pp. 143–146.

[24] Sellery to Guerlac, 15 Apr. 1941, Sellery papers, University Archives; cf. Henry Guerlac, referee's report: "In his correspondence with me the letter of Dean Sellery offered me the job of establishing a 'Department of the History of Science.' No mention was made of a course on the 'History and Significance of Science.' "

a fast pace. At one chance encounter Sellery asked Guerlac what material he intended to cover. Guerlac replied, "Antiquity to Newton during the first semester and Newton to Einstein during the second." "No you won't," commanded Sellery, "you'll do the whole thing from the Egyptians to Einstein the first semester and repeat the course the second semester. Next year you can divide the course however you wish." The result was demanding. Just one week after Pearl Harbor, Guerlac's students were handed a typical examination. The major question, for which they were given twenty minutes, was apparently inspired by E. A. Burtt's *Metaphysical Foundations of Modern Science:* "A fundamental revolution in the *method* and *metaphysics* of science took place between 1600 and 1700. Describe it as well as you can and indicate the contributions to this method and this metaphysics of Galileo, Francis Bacon, René Descartes, and especially of Newton."[25]

Since Guerlac was responsible for developing an entire department, he quickly entered the titles of advanced courses into the course catalogue: "American Science and Technology," "Science and the Enlightenment," and "Pro-Seminar in the History of Science." Before Guerlac was able to develop these courses, however, events intervened. Guerlac's dissertation on the relationship between science and war made him realize the importance of having a historian document the scientific projects undertaken during World War II. In 1941–1942 Guerlac gave a seminar on science and war at Wisconsin "chiefly for the benefit of Professor Farrington Daniels and his co-workers on the National Defense Research project."[26] Meanwhile Guerlac conversed with various persons considering the possibility of adding a historical section to the National Defense Research Council. In spring 1943 Guerlac accepted a position as historian with the Radiation Laboratory of the Massachusetts Institute of Technology.

DEPARTMENTAL REACTIVATION

The fate of the Department of History of Science, dependent before the war upon the actions of Dean Sellery, depended in the postwar years upon Sellery's successors. An unsympathetic dean could easily have let the department remain dormant. The postwar dean, however, was the mathematician Mark Ingraham, who proved to be as committed to history of science as Dean Sellery—indeed, more so. Not only did Ingraham have a quasi-professional interest himself in the history of mathematics (he taught an occasional course on the subject), but he shared the humanist's perspective on science as part of culture and was an eloquent spokesman for the value of interdisciplinary studies.[27] As a result Ingraham not only reactivated the department but also gave continuing support in the belief that Wisconsin should become a national center for the study of history of science.

[25] Conversation with Henry Guerlac, Jan. 1980; examination for History of Science 1, 15 Dec. 1941, Sellery papers, University Archives.

[26] Guerlac to F. W. Loomis, Associate Director of Radiation Laboratory, MIT, 5 Jan. 1943, Mark Ingraham papers, University Archives.

[27] Donna S. Taylor, interview of Mark H. Ingraham, 1974, University Archives; "Memorial Resolution of the Faculty of the University of Wisconsin on the Death of Emeritus Professor and Emeritus Dean Mark H. Ingraham," Faculty Document 514, 7 Mar. 1983.

Ingraham's term as Dean of Letters and Science began in July 1942, shortly before Guerlac left for MIT. In fall 1945 Ingraham, impressed by what Guerlac had accomplished before leaving, began to make plans for his return. Competing with Wisconsin for Guerlac's favor, however, was Cornell University, an institution with which Guerlac and his family had long-standing attachments. In an attempt to bring Guerlac back to Madison, Ingraham wrote: "You know that I am enthusiastic about your field, since I have always cared a great deal for the historical aspects of any development and have felt that the scientists were not sufficiently awake to the cultural importance of the history of science or the importance it has for them even as technical scientists." Ingraham also offered to promote Guerlac directly from assistant professor to full professor—at double his former salary. In spite of all inducements, however, Guerlac chose the Cornell appointment.[28]

Ingraham concluded that Guerlac turned down Wisconsin simply because he preferred to be at Cornell. Guerlac made his decision for many reasons, however. He was concerned about library resources in Madison, and he looked forward to the opportunity to teach engineering students, who presumably were already acquainted with science, at Cornell. Further he was sensitive to the issue of teaching versus research at Wisconsin. When he first arrived, he had been asked to fill out his teaching load by serving as a teaching assistant in a course on general European history. The department had originated out of a concern for general education: its mission was teaching, not research, and the course on history and significance of science was originally intended to introduce science to a large number of students without infringing too greatly upon faculty time. After the war Guerlac was ready to plunge immediately into research and help establish history of science as a productive professional discipline.[29]

What Guerlac could not easily have foreseen was that the University of Wisconsin would be a vastly different place in the immediate postwar years than it had been at the end of the depression. The Farrington Daniels Curriculum Committee reported at the end of a decade of retrenchment; the postwar years began a quarter century or more of expansion. Increased enrollment during the postwar period provided opportunities as well as problems. These opportunities included the development of new academic specialities such as the history of science, a subject that in itself seemed dramatically more important to a world that had entered the atomic age.

Having failed to convince Guerlac to return, Dean Ingraham on 31 December 1945 appointed a committee chaired by Robert Reynolds to supply him with staffing recommendations for the History of Science Department. Reynolds had also been away from Wisconsin during the latter part of the war, but unlike Guerlac he returned convinced that a new day had dawned for the university. In an article entitled "The University of Wisconsin during the Next 10 Crucial

[28] Mark Ingraham to Guerlac, 1 Dec. 1945; Guerlac to Ingraham, 17 Dec. 1945; Ingraham papers, University Archives.

[29] Conversation with Guerlac, Jan. 1980. Guerlac had also decided that if he returned to Wisconsin, it would be as a member of the History Department; but he felt that a crucial interview with the historian of American thought Merle Curti had not gone well. Ironically, Curti had urged Ingraham to do everything possible to keep Guerlac; Merle Curti to Ingraham, 21 Nov. 1945, Ingraham papers, University Archives.

Years," Reynolds stated in May 1946 that "most men are convinced that bigness means competence in general, and even more specifically, that its bigness means a great University affords a wealth of training in special fields." Reynolds considered the university's growth inevitable, not merely because of returning veterans, but because of the long-range historical trend according to which an ever-increasing percentage of the population sought education at higher and higher levels. Looking ahead a decade, Reynolds predicted that by 1956 the consequences would be a great flourishing of the liberal arts:

> By 1956 . . . it will be precisely inside the area of liberal arts work that the greatest variegation, expansion of faculty and offerings, and expansion in enrollments will all have taken place. Purely in the course of staffing up with the hundreds more professors who will have to be added so we can instruct the swollen underclassmen student body, scores of talented linguists, philosophers, mathematicians, political scientists, historians, artists, economists, and others in the arts and humanities will have to be recruited. They will be offering at advanced levels and to graduate students a variety of arts courses far more extensive than ever before offered in any centers of learning in the world, and to larger enrollments of better qualified students.[30]

Reynolds did not specifically mention "historians of science," but there is no doubt that he had them in mind, for at the time he was chairing the committee on the history of science. Owing to Reynold's vision, shared by other faculty members, the committee did not simply seek a replacement for Guerlac; instead it sought to lay the groundwork for a complete undergraduate and graduate program in history of science by the appointment of two historians of science. Writing candidly to the medievalist Lynn Thorndike, with whom he was in correspondence regarding the new appointments, Reynolds spelled out "the unofficial thinking" of the committee regarding the future of history of science at Wisconsin:

> From now on, it is reasonable to expect two men and a staff of qualified graduate students will have a large enrollment to care for. Clearly, there will be a foundation of teaching load to justify having professors and to support advanced graduate students, obligating the professors to put in advanced and post graduate work for the latter.
>
> Two professors in Letters and Science, a Medical Historian, giving advanced courses in his own speciality but helping in the department's other work, and Urdang (also available for part time and advanced work?) this all would add up to quite a center for History of Science. . . .
>
> As to mechanisms, budgets, and such practical matters, the picture is beautiful. Can we get the men who will create a great department?[31]

Reynolds's committee worked hard to get the names of men who could "create a great department." By soliciting recommendations from Henry Guerlac, George Sarton, Lynn Thorndike, Charles Singer, Henry Sigerist, and others, the committee put together a preliminary list of about thirty candidates

[30] Ingraham to Robert Reynolds, 31 Dec. 1945, University Archives; Reynolds, "The University of Wisconsin in the Next 10 Crucial Years," *Wisc. Alum.*, 1946, *47*:13; Other Robert L. Reynolds papers are in the State Historical Society of Wisconsin.

[31] Reynolds to Lynn Thorndike, 24 Oct. 1946, Ingraham papers, University Archives.

for the two positions, but many were not really historians of science.[32] The committee's preference was for younger historians of science, and ultimately the two men chosen were Robert C. Stauffer and Marshall Clagett. Since Stauffer's scientific background and historical interests lay in the biological realm, the second appointment was felt appropriate for a specialist in the history of the physical sciences. The most frequently recommended candidate was I. Bernard Cohen, who like Stauffer was completing his work at Harvard. Sarton pronounced Cohen to be the only candidate to possess all the scientific and historical qualification needed, and plans were to appoint Cohen and Stauffer as a pair. After coming to Madison for an interview, however, Cohen decided to remain in Cambridge.[33] The second appointment subsequently dragged on for almost a year while an attempt was made to find a historian of physical science with a modern emphasis.[34] Finally, however, Marshall Clagett, a student of medieval physics and mathematics who had completed his Ph.D. under Lynn Thorndike just before the war, was appointed in May 1947. Notwithstanding the reservations about appointing a specialist in ancient and medieval sciences, Clagett's appointment proved an excellent one. In accepting Wisconsin's offer, Clagett indicated to Dean Ingraham that he realized that widespread support for history of science existed at Wisconsin and that a separate department provided considerable advantages:

> I was struck by three things on my visit. First of all, you have a program that shows that you believe the History of Science to be important not only as a background for science students, but as a cultural contribution for the less specialized student. Second, I was much impressed by the fact that your various departments, science as well as history, seem to be in back of the plan. This I believe to be absolutely indispensable for the success of any general program in the History of Science. Third, you have had the farsightedness to make it a separate department. This should allow, in the future, for majors in the History of Science, an offering unique in American colleges.[35]

A "GENERAL UNIVERSITY PLAN" (1946–1947)

Reactivation of the History of Science Department was not the only fruit of a year that promised a "beautiful" outlook for history of science at Wisconsin with

[32] Not all those contacted by Reynolds believed that Wisconsin had a history of science department. Charles Singer wrote: "I rather gather from your letter that what you are thinking of is a man who would work in the Department of History and would help to give something of the scientific background of history. I gather this is more in your mind than the establishment of an actual department of history of science"; Singer to Reynolds, 4 Feb. 1946, Hist. Sci. Dept. files.

[33] George Sarton to Reynolds, 17 Jan. 1946, Hist. Sci. Dept. files. Sarton enumerated the requirements of an ideal historian of science: "I have always claimed that the qualifications of a teacher of history of science are in order of importance: (1) first-hand knowledge of one field of science or another with as much practical and professional experience as possible; (2) sufficient, if more superficial, knowledge of other fields of science; (3) knowledge of history and historical methods; historical 'sense'; (4) sufficient philosophical knowledge and interest; (5) sufficient linguistic ability. This may seem rather vague but could not be made more precise without longer explanation out of place here and now. The main point is the fundamental value of first-hand scientific knowledge and experience. Nothing can replace that. It is absolutely necessary, yet not sufficient."

[34] "Should we stress the work in Ancient or Medieval Science or encourage our men to try to work on the growth and cross-influences of Modern Sciences? We can do the latter best, and the field is promising. We can leave to Columbia, Harvard, Brown, and European schools the work which our library cannot now sustain"; Reynolds to Thorndike, 24 Oct. 1946.

[35] Marshall Clagett to Ingraham, 27 May 1947, Ingraham papers, University Archives.

respect to budgets and mechanisms. Some of the unofficial expectations Reynolds had confided to Thorndike involved plans for history of science outside the department proper. Reynolds had expressed the hope that the two historians in the College of Letters and Science officially recommended by his committee would be joined by a medical historian in the Medical School and by George Urdang, the historian of pharmacy. He also mentioned that the university was expected to purchase the Thordarson Library of rare scientific books. "While others on the committee and in the administration think along these lines," Reynolds told Thorndike, "concrete policy looking that way has not been set down."[36] No official document was drawn up, and Reynolds himself turned over the chairmanship of the committee on history of science in October 1946 to the chemist Norris F. Hall. Nonetheless, it was generally understood during 1946–1947 that the university was promoting history of science along several fronts. President Edwin B. Fred backed the rare book purchase, and support for the appointments in history of medicine and history of pharmacy came from administrators in the Medical School and the Pharmacy School respectively.

The purchase of the Thordarson collection was a particularly significant development. The university had acquired the libraries of William Snow Miller and Edward Kremers upon their deaths. The death in February 1945 of the electrical inventor and bibliophile Chester H. Thordarson, however, provided a unique opportunity, as described by the university's library director Gilbert Doane, for Wisconsin "to move to the front rank of those having notable libraries." In his will Thordarson gave the university first chance to purchase his library, assembled with professional assistance, which contained eleven thousand volumes and was rich in English scientific literature. Magnificently represented were natural history (e.g., the Audubon folios and other illustrated works for ornithology), agriculture (e.g., several hundred pre-1700 volumes on horticulture), herbals, sixteenth- and seventeenth-century works on technology, health, and cookery. Less well represented, but still numbering hundreds of books, were the physical sciences (e.g., all four seventeenth-century printings of William Gilbert's *De Magnete*). In January 1946 the university took a twelve-month option to purchase the Thordarson collection—valued at upwards of a million dollars—for a sum not to exceed $270,000 plus a $30,000 broker's fee. In August 1946 the books themselves were moved to Madison from the inaccessible shores of Rock Island, Wisconsin, where they had been stored in Thordarson's immense Viking-style boathouse. During the fall the university's acquisitions librarian examined the books carefully and advanced additional arguments in favor of their purchase. In late December 1946 the Board of Regents approved the Thordarson acquisition.[37]

Other aspects of the plans for history of science were also going smoothly. Administrative backing for the history of medicine was ensured when William

[36] Reynolds to Thorndike, 24 Oct. 1946.

[37] Quoting Doane from *The Daily Cardinal*, 26 Jan. 1946; Much of this account is derived from John Neu, "The Acquisition of the Thordarson Collection," *U. W. Library News*, 1966, *11*:1–6. See also J. Christian Bay, "Bibliotheca Thordarsoniana: A Private Collection of Scientific and Technological Literature," *The Papers of the Bibliographical Society of America*, 1929, *23*:1–17. Ralph Hagedorn, "Bibliotheca Thordarsoniana: The Sequel," *Pap. Bibl. Soc. Amer.*, 1950, *44*:29–54. Neil M. Clark, "The Flare of Northern Lights Started Thordarson on His Quest," *American Magazine*, 1926, *102*:36–37, 183–190.

Middleton, a participant in Miller's medical history seminar, became Medical School dean. Miller's seminars had been extracurricular, but Middleton, who wrote occasional papers on medical history, wanted to see history of medicine included in the Medical School curriculum and required of medical students. The very same month that Reynolds described his expectations to Thorndike, Middleton outlined in similar terms how medical history fit into what he called the "general University plan" for history of science:

> The University of Wisconsin Medical School is planning to embark upon a program of extension into the field of history of medicine. This development is part of a general University plan which includes the history of Pharmacy, of Biological Science, and of Mathematical and Chemical Sciences. In the composite picture of cultural evolution it is hoped that Medicine may take a prominent place.[38]

A chance to appoint a medical historian came in 1946 when a prominent university benefactor inquired of Middleton whether development of any areas of medicine would enrich the Medical School, but "would not be supported by tax money through the Regents and legislature." Middleton named biophysics and history of medicine. The history of medicine position was first tendered—perhaps only as a courtesy—to George Urdang, who had remained in Madison without university affiliation since arriving in 1938 to help Edward Kremers complete *History of Pharmacy*. Urdang was living in modest circumstances, but he declined Middleton's offer on the grounds that a historian of medicine should himself be a medical man. Middleton then offered the medical history position to Erwin H. Ackerknecht, a German-born medical historian who had been a student in Leipzig of Urdang's friend and fellow emigré Henry Sigerist. At the time, Ackerknecht was employed as assistant curator of anthropology at the American Museum of Natural History and was well known in the United States from his study of malaria in the Upper Mississippi Valley. Ackerknecht accepted Middleton's offer and began teaching history of medicine at Wisconsin in January 1947. Concurrently the Medical School made the course on medical history a requirement for second-year medical students.[39]

Creation of a position in history of pharmacy lagged behind that in history of medicine by only a few months. The successor to Edward Kremers as director of the Pharmacy School was Arthur H. Uhl. Uhl had attempted before the war to arrange a faculty position for Urdang, but appointments in pharmacy (because

[38] W. S. Middleton to E. H. Ackerknect, University Archives, quoted in Guenter B. Risse, "An Account of the Wisconsin Chair in Medical History: A Tribute to William S. Middleton," *Bull. Hist. Med.*, 1976, *50*:133.

[39] Steven Lowe, "The University Medical School: A Personal History" (interview with William Shainline Middleton), 1972, p. 63, University Archives. For the donor, Thomas E. Brittingham, Jr., consult Risse, "Wisconsin Chair in Medical History," pp. 133–137; Paul F. Clark, *The University of Wisconsin Medical School, A Chronicle, 1848–1948* (Madison: Univ. Wisconsin Press, for the Wisconsin Medical Alumni Association, 1967), pp. 156–159. The Ackerknecht appointment prompted Henry Sigerist to write George Urdang: "The University of Wisconsin will be able to develop a strong group that will put to shame the endowed universities that have been talking all the time about the necessity of study and instruction in the History of Science, but have never been acting in the matter"; Sigerist to Urdang, 22 Oct. 1946, quoted in Glenn Sonnedecker, "The American Correspondence between George Urdang and Henry J. Sigerist 1941–1948," in *Festschrift für Rudolf Schmitz zum 65. Geburtstag: Perspektiven der Pharmaziegeschichte* (Graz: Austria, 1983), p. 358.

the Pharmacy School was then a unit of the College of Letters and Science) needed approval of the Dean of Letters and Science, and Uhl was unsuccessful. In 1941, however, Uhl convinced the Milwaukee malted-milk manufacturer Alexander J. Horlick to donate funds to help realize Urdang's plans for an American Institute for the History of Pharmacy. Urdang became director of the AIHP, which, although located in Madison, remained independent of the university. During the 1940s Urdang's interaction with various faculty members helped to sustain an enthusiasm for history of science. In 1947 Uhl at last received Dean Ingraham's blessing, and Urdang was made a professor of history of pharmacy. In his inaugural lecture, delivered at age sixty-five, Urdang attributed recent interest in history of science to postwar awareness of an "incongruity between our civilization and our culture, the enormous advances of science on the one side and our incapacity for coping with those advances for the sake of a standing order of life on the other."[40]

Not mentioned by Reynolds in his letter to Thorndike—but probably known to him—was that the chairman of the Chemistry Department had recently encouraged a younger member of his department who wished to revive the course on history of chemistry. Although in the postwar period few members of Wisconsin's Chemistry Department considered knowledge of history of chemistry essential for the practicing chemist, Edward Kremers had laid foundations for the teaching of history of chemistry. When Kremers was on leave in 1920, history of chemistry was assigned to the chemist Louis Kahlenberg, who subsequently refused to relinquish the course to its creator. Upon Kahlenberg's retirement in 1940, history of chemistry was assigned to Norris F. Hall, who had a genuine, if somewhat incidental, interest in history but never taught the course.[41] Aaron J. Ihde assumed responsibility for history of chemistry in summer 1946. A food chemist who had received his Ph.D. from Wisconsin's Chemistry Department in 1941, Ihde had been a member of the faculty since 1942. Although he had himself taken no courses in general history since high school, Ihde soon found that history of chemistry could serve an important role in the education of chemistry students by providing an overview of the entire field. Ihde also became fascinated by historical research, and during the 1940s George Urdang strongly supported his work in history of chemistry. In one of his first historical papers, published in 1948, Ihde challenged the assumption that scientific discoveries are caused either by individual genius or social need by arguing that discoveries become almost inevitable when—but only when—the requisite background has been developed.[42]

[40] Taylor, interview of Arthur Uhl (cit. n. 15), pp. 9–15; H. George Wolfe, "George Urdang, 1882–1960: The Man and His Work," *Pharm. Hist.*, 1960, *5*:33–42; quoting from George Urdang, "History of Pharmacy as an Academic Discipline," *Journal of the History of Medicine and Allied Sciences*, 1948, *3*:9. See also [Glenn Sonnedecker], The *George Urdang Room—An Interpretation* (Madison, Wis.: American Institute for the History of Pharmacy, 1978), pp. 7–8. Between the time that Edward Kremers taught history of pharmacy and Urdang's appointment in 1947, the history of pharmacy course was taught by W. O. Richtmann; consequently Urdang could boast that "from 1907 until the present, there has never been an interruption in teaching of pharmaceutico-historical subjects at the School of Pharmacy at the University of Wisconsin"; George Urdang, "Teaching the History of Pharmacy," *American Journal of Pharmaceutical Education*, 1950, *14*:136–140.

[41] Hall once delivered a paper on the evolution of the concept of an acid to a meeting of the group convened by Kremers; Kremers Reference Files, PPL; Kremers, "Kahlenberg," pp. 14–15 (cit. n. 7).

[42] Aaron J. Ihde, "The Inevitability of Scientific Discovery," *The Scientific Monthly*, December

Partly by luck and partly by design, elements of the unofficial plan to make Wisconsin a center for the history of science were thus in place by mid-1947. By proceeding simultaneously on several fronts while times were propitious, the individuals concerned had effected a much larger involvement in history of science than could have been accomplished in any other way. The appointments of historians of medicine and pharmacy had set the stage for independent development of historical programs in the Medical School and the Pharmacy School. Following the precedent of the History of Science Department, the Department of History of Medicine achieved formal departmental status in July 1950. In 1954 Erwin Ackerknecht and Dean Middleton made plans for expanding the History of Medicine Department, particularly in the area of graduate teaching—although these plans were delayed by Ackerknecht's acceptance in October 1956 of a medical history position at the University of Zurich. Urdang's appointment in the Pharmacy School led to establishment of a continuing program in history of pharmacy and ultimately to the granting of Ph.D.s in the subject. Upon Urdang's retirement in 1952, Glenn Sonnedecker, who that year completed Wisconsin's second doctorate in history of science, was appointed to the history of pharmacy position.[43]

Acquisition of the Thordarson library likewise set a precedent for expansion of the university's rare book holdings, including those in history of science. In 1951 Wisconsin purchased three thousand volumes of alchemy and early chemistry from Dennis I. Duveen, the chemical manufacturer and Lavoisier bibliographer. The Duveen purchase created more controversy among the regents than had the Thordarson acquisition: one regent protested that the university should be an "up-to-date" institution with "up-to-date tools," but others thought that old books might contain important discoveries previously overlooked. Regardless of any regent's misgivings, the Thordarson and Duveen purchases were followed by others in the history of science, and in 1963 John Neu was appointed to manage acquisitions in history of science full-time.[44] In 1967 Neu became editor of the *Isis Critical Bibliography*.

1948, pp. 427–429. Although Ihde had taken no courses in history *per se*, he had taken Kahlenberg's history of chemistry as a senior in college (1930–31). See further Aaron J. Ihde, "History of Chemistry at the University of Wisconsin," *Isis*, 1951, *42*:308; Ihde, "The History of Chemistry Program at the University of Wisconsin," *Badger Chem.*, Winter 1967, No. 14, pp. 14–16. Aaron J. Ihde, "History of Chemistry at the University of Wisconsin," in *Teaching in History of Chemistry: A Symposium, San Francisco, California, U.S.A., April 1968*, ed. George B. Kauffman (Budapest: Academiai Kiado, 1971), pp. 171–178. At first organic or physical chemistry was a prerequisite for History of Chemistry, and therefore the course was usually taken by seniors and graduate students. See also William K. Alderfer, interview of Aaron Ihde, 15 May 1963, SHSW.

[43] Risse, "Wisconsin Chair in Medical History" (cit. n. 38) p. 135; George Urdang, "Graduate Work in History of Pharmacy," *Amer. J. Pharm. Educ.*, 1950, *14*:153–156.

[44] Quoting Daniel H. Grady from *Capital Times* (Madison), 13 Jan. 1951; Vice-President Ira L. Baldwin claimed that an idea he had found in an old volume led to a modern method of inoculation of legumes, to which Grady rejoined, "Surgeons do not go back to the days when barbers did the operating." See also Samuel A. Ives and Aaron J. Ihde, "The Duveen Library," *Journal of Chemical Education*, 1952, *29*:244–247; John Neu, ed., *Chemical, Medical and Pharmaceutical Books Printed before 1800 in the Collections of the University of Wisconsin Libraries* (Madison: Univ. Wisconsin Press, 1965). Additional acquisitions in history of science included the purchase in 1953 of the Hugh Sinclair collections on Robert Boyle and Joseph Priestley, and more recently the William A. Cole collection in 18th- and 19th-century chemistry and the George White collection in early geology. The Medical Library, under the direction of Helen Crawford, was responsible for the acquisition in 1970 of the Library of the Royal Medical Society of Edinburgh.

The existence at Wisconsin of a History of Science Department, a History of Medicine Department, and a separate program in history of pharmacy in the Pharmacy School made for a distinctive set of institutional arrangements. At first cooperation among Wisconsin's several historians of science remained unofficial. In January 1948 Ackerknecht wrote to Dean Middleton simply that "cooperation with Drs. Clagett, Stauffer, and Urdang has been most cordial and regular." Lacking a better term, the four historians of science appointed to the faculty during 1946–1947—Erwin Ackerknecht, Marshall Clagett, Robert Stauffer, and George Urdang—referred to themselves collectively as the History of Science "group." These four, with other faculty members interested in history of science (including some who had played a role in the events leading to the establishment of history of science at the university), met monthly between 1950 and about 1960 to hear papers and exchange ideas informally as members of the History of Science Journal Club. Eventually, however, all professional historians of science at the university received joint membership in the History of Science Department.[45]

THE ERA OF EXPANSION (1947–1969)

On a cold winter's day in January 1947 Robert C. Stauffer arrived in Madison to set up shop. What he found upon his arrival was a small office in Bascom Hall almost destitute of all furniture and lacking even a telephone, but situated within a university full of good will towards history of science. When Marshall Clagett joined Stauffer for the fall term of 1947–1948, the first full-fledged department of history of science at any American university was once again underway.[46]

Although neither Stauffer nor Clagett had specialized knowledge of atomic physics, some of the enthusiasm that greeted the reactivation of the department was based upon the assumption that historians of science could contribute to an understanding of the atomic age. Thus in spring 1948 Clagett joined several faculty members led by Farrington Daniels, recently returned from his wartime activities at the Metallurgical Laboratory, in the revival of "Contemporary Trends"—the senior survey proposed along with "History and Significance of Science" by the Daniels Committee in 1940. Nicknamed "Atomic Age 103," Contemporary Trends 103 confronted such topics as "atomic energy," "scientific background," and "working for a peaceful, practical world."[47] When interviewed by the *Daily Cardinal,* the student newspaper, in October 1947, Stauffer and Clagett indicated that their courses were concerned with what might be called the sociology of science. The reporter quoted Clagett as saying that "the history of science can, for both non-scientists and scientists, elucidate the his-

[45] Quoting Ackerknecht to Middleton, 5 Jan. 1948, Middleton papers, University Archives. The History of Science group sponsored the symposium published as Robert C. Stauffer, ed., *Science and Civilization* (Madison: Univ. Wisconsin Press, 1949). The symposium, part of the University of Wisconsin's centennial celebrations, took place 13–14 Jan. 1949. Apart from historians of science, most members of the journal club were scientists; Lowell Noland was a particularly frequent participant, Hist. Sci. Dept. Files.

[46] Marshall Clagett, "History of Science Instruction at the University of Wisconsin," *Isis,* 1952, *43*:51–53.

[47] *Wisc. Alum.,* 1948, *49*:4.

toric effect of science on society. We can help the student make the conclusions for himself regarding the relationship between science and society today." These remarks, however, did not mean that historians of science should focus their attention upon policy issues. Stauffer and Clagett had a rather different message: at a time when the successful mobilization of scientific manpower in the Manhattan project was obvious, they impressed upon the reporter that "scientific discovery is an individualistic enterprise, and that it cannot be organized in a military manner."[48]

In the end the historical understanding of science could not be confined to the problems raised by the atomic age. The immediate task confronting Stauffer and Clagett upon their arrival was the resurrection of the course on history of science mandated by the Daniels Committee. Here the two took the traditional approach of the intellectual historian rather than the novel approach of the sociologist of science. Guerlac's title, "Survey of the History of Science," was changed a few years later, but the catalogue description remained essentially that laid out before the war:

> 1a–1b. *Introduction to the History of Science* Yr; 3 cr. The first semester covers the development of science in the period from Antiquity through the Age of Newton; the second from the later eighteenth, nineteenth, to the early twentieth centuries. Prerequisites: One year of laboratory science; sophomore standing. Mr. Clagett, Mr. Stauffer.

In 1949 Stauffer characterized the course as "a 'name' course primarily, tracing the influences of Kepler and Copernicus, Al-Kwarizmi and Archimedes—and building the story of science's advancement around the individual researches and discoveries of scientists down through the ages—often widely separated by time and distance."[49]

A curriculum change in 1946 that allowed students majoring in the humanities and social sciences to count history of science towards their required courses in the natural sciences ensured large enrollments in the introductory course.[50] One hundred fourteen students enrolled in Robert Stauffer's first class, offered spring 1947. From 1948–1949 on, two parallel sections of the introductory course were offered, one aimed at science majors, taught by Marshall Clagett, the other at nonscience majors, taught by Stauffer. This division was ultimately dropped, but two sections were offered fall and spring during most of the 1950s and 1960s. Between 1948 and 1965 the total yearly enrollment never dropped much below four hundred nor rose much above six hundred; the course generated almost 90 percent of the department's entire annual enrollment.

Robert Reynolds had predicted that a professor of history of science might

[48] "History of Science Courses Added to UW Curriculum," *Daily Cardinal,* 16 Oct. 1947.

[49] UW *Bulletin,* 1948–1950, p. 154; "Stauffer," *Wisc. Alum.,* 149, *50*:18. Upon discovering that their history of science instructor considered Thomas Edison less worthy of treatment than obscure Arabic scientists, five returning GIs were sufficiently alarmed to complain; five veterans to Ingraham, 2 May 1947, Ingraham papers, University Archives.

[50] "Report of the Curriculum Committee," Letters and Science Document 84, January 1946, pp. 72–75 (known as the Ogg report, after the chairman, Frederick A. Ogg). Prior to 1946 students could receive a B.A. without any courses in science. The Ogg committee recommended 15 credits in natural science, of which 9 were to be in laboratory courses, for humanities and social science students. History of science was allowed to count towards the remaining 6 natural science credits.

have to face a lecture audience of between two hundred and five hundred undergraduates. Although no single lecture section of History of Science 1a–1b ever quite reached five hundred, enrollment was sufficient to justify the existence of the department and—as Reynolds's committee had anticipated—to provide a basis for the expansion of higher course offerings.

In the fall of 1947 Robert Stauffer wrote to Henry Guerlac, "we even have two graduate students for whom we now have to organize a program." Five years later, surveying his advanced history of science courses, Marshall Clagett discovered an enrollment dominated by graduate students, some majoring in history of science and some from other departments.[51] This turn towards a graduate-student clientele was not foreseen. Clagett had predicted in accepting his appointment that an independent history of science department would lead to "majors in the History of Science, an offering unique in American colleges," and an undergraduate major in history of science was indeed approved that year (1947–1948). For many years, however, there were few takers and—perhaps because of the guaranteed large enrollment in the introductory course—nothing was done to increase the major's popularity. Growth of graduate studies, on the other hand, was steady, even though the department's initial bid to administer a separate Ph.D. program failed.[52] In 1948 joint doctoral programs were established between History of Science and the Chemistry Department, the History Department, and the School of Pharmacy. The program with Chemistry required a preliminary examination in three fields of chemistry and was available only to students "with undergraduate training comparable to a major in chemistry." The History Department voted to accept history of science as a field for the preliminary examination in history and to allow history of science students to take as much as one fourth of their required course work in history.[53]

Most of the department's first graduate students came with previous study at the graduate level in one of the sciences, but the reasons they stated for embarking upon graduate work in history of science were predictably diverse. Several arrived with careers interrupted by the war, among them a graduate student in chemistry who had become interested in history of science while in the navy, a chemist who had known Farrington Daniels while both were at the Metallurgical Laboratory, and a wartime writer with Douglas Aircraft who expected

[51] Stauffer to Guerlac, 25 Nov. 1947, Hist. Sci. Dept. files; Clagett, "History of Science Instruction" (cit. n. 46), p. 53; 13 of 16 students in Clagett's advanced course on ancient science were graduate students.

[52] This proposal, developed during 1947–1948, would have made for closer cooperation between the History of Science Department and the History Department in the administration of doctoral work in history of science than subsequently evolved. The four historians of science (Clagett, Stauffer, Urdang, and Ackerknecht) were to have been joined in the History of Science Department by the historians Merle Curti, Gaines Post, and Paul Farmer; see Hist. Sci. Dept. files. (Only the parts of the proposal concerning the M.A. degree received approval; Graduate School Document 29, March 1948.) In 1952, however, Clagett wrote that "an unusually close and amicable relationship exists between the History and History of Science Departments"; Clagett, "History of Science Instruction," p. 53.

[53] "Report of a Committee to Consider Requirements for a Ph.D. Joint Major in History of Science and Chemistry" (members of this Chemistry Department committee were Aaron Ihde [chair], Farrington Daniels, Norris F. Hall, S. M. McElvain, and Henry A. Schuette), adopted by Chemistry Department, 13 Apr. 1948, Hist. Sci. Dept. files; minutes of the Department of History, 16 Feb. 1948, p. 2.

Historians of science at the University of Wisconsin, 1952. Left to right: *Glenn Sonnedecker, Georg Urdang, Erwin Ackerknecht, Carl Condit, Marshall Clagett, Erwin Hiebert, and Robert Stauffer. Photo courtesy of Glenn Sonnedecker.*

to work towards a dissertation on aviation science. The next generation included a student educated in Catholic universities who wanted to study "the impact of the developing sciences upon the philosophical thinking of the West," a teacher of chemistry and physics at an American university in Istanbul who had become interested in the history of Arabic science, a General Electric Company executive who had decided that history of science could lead to advancement in his company, and a Cornell University engineering student whom Henry Guerlac had steered towards Wisconsin. These were all among the first fifteen students to receive a Wisconsin doctorate in history of science.

Marshall Clagett, arriving at Wisconsin with his investigations into the medieval background of modern science well under way, brought excitement to the graduate program in the early years. The importance of Clagett's work—and the availability of Clagett's growing collection in microfilm of medieval mathematical and physical manuscripts—diverted some graduate students into the history of medieval science. Thus the student who intended to write a dissertation on aviation science, Thomas M. Smith, produced instead a thesis on a successor of the fourteenth-century figure Nicole Oresme. Indeed no fewer than three of the first thirteen (and four of the first twenty-three) dissertations in history of science at Wisconsin concerned Oresme or his influence. There was never any danger, however, that the Department would have to change its name to the Department of Oresme Studies. The first Ph.D. in history of science was completed in August 1952 (awarded 1953) by Robert Siegfried, whose thesis was a pioneering quantitative study of American chemical research publications in the nineteenth century. Siegfried's sponsor was Aaron Ihde. The second Ph.D. was completed in 1952 and awarded in 1953 to Glenn Sonnedecker for a study of nineteenth-century American pharmaceutical education; Sonnedecker had been a staff

member of a pharmaceutical journal before deciding to study history of pharmacy with George Urdang. The chemist who knew Farrington Daniels during the war, Erwin N. Hiebert, received his degree in 1954 for a study of the concept of mechanical work prior to 1750.[54]

High enrollments and graduate applicants might not have been enough, however. The department's scholarly endeavors could well have fallen short of the high expectations of 1946–1947, and other faculty members concluded that the field was not yet an academic discipline. But Marshall Clagett's investigations into medieval physics and mathematics quickly dispelled any doubts regarding the scholarly legitimacy of either department or discipline. In 1955 Clagett published *Greek Science in Antiquity* and soon he was readying his imposing *Science of Mechanics in the Middle Ages* for press.[55] Wisconsin's scientists could all appreciate the importance of studying the medieval predecessors of Galileo and Newton, while recognizing that such study required historical and linguistic qualifications the scientists themselves did not possess. Humanists likewise admired Clagett's scholarship and his combination of scientific and linguistic virtuosity.

During this same period the discipline as a whole was gaining national acceptance. Upon the tenth anniversary of the department's reactivation, Wisconsin historians of science helped celebrate the new profession's coming of age. While Marshall Clagett was abroad in 1955–1957 visiting European libraries, the Joint Committee on the History and Sociology of Science of the Social Science Research Council and the National Research Council approved a proposal for holding a major summer institute that would allow historians of science to exchange ideas at greater leisure and in more depth than was possible during the hurried encounters at the annual meetings of the History of Science Society. Dean Ingraham, a member of the joint committee, suggested Wisconsin as the logical host institution. After much planning and correspondence, seventy-three historians of science converged upon Madison the first eleven days of September 1957 for the Institute for the History of Science. In the dormitory that housed the participants, a topic of intense informed discussion was the nature of the discipline of history of science. The formal proceedings were edited by Clagett and published two years later as *Critical Problems in the History of Science*.[56]

[54] Thomas M. Smith, "A Critical Text and Commentary upon *De Latitudinibus Formarum*," 1954; Robert Siegfried, "A Study of Chemical Research Publications from the United States before 1880," 1952; Glenn A. Sonnedecker, "American Pharmaceutical Education before 1900," 1952 (see also Glenn Sonnedecker, "George Urdang as My Teacher and Colleague," *Pharmacy in History*, 1960, *20*:20ff); Erwin N. Hiebert, "The Development of the Concept of Mechanical Work to 1750," 1954. On Clagett's impact, see "Research Without Test Tubes," *Wisc. Alum.*, 1950, *51*:16–17. In refereeing this article Clagett wrote: "I see a certain difficulty in Hilts' catching the *esprit* of the early days and in his discussion of the early theses. But, I suppose it could hardly be otherwise since he was not present." I plead guilty on all counts.

[55] Marshall Clagett, *Greek Science in Antiquity* (New York: Schuman, 1955); Clagett, *The Science of Mechanics in the Middle Ages* (Univ. Wisconsin Publications in Medieval Science) (Madison: Univ. Wisconsin Press, 1959). Robert Reynolds was among those involved in setting up the series on medieval science; Reynolds to T. Webb, 13 Nov. 1959, Reynolds papers, SHSW.

[56] Marshall Clagett, ed., *Critical Problems in the History of Science* (Proceedings of the Institute for the History of Science at the University of Wisconsin, September 1–11, 1957) (Madison: Univ. Wisconsin Press, 1959) (see the retrospective review in *Isis*, 1981, *72*:267–283). The original plans included more topics in the sociology of science; several themes suggested, however, were rejected

The next decade, 1957–1967, saw the History of Science Department at Wisconsin increase its faculty from two to ten. Although the department was strong in early mathematics and physics, in 1957 it still lacked the balance in modern science originally contemplated. That year Erwin Hiebert joined the department as a historian of modern physics. A fourth member was already at the university. Aaron Ihde's interest in history had increased during the 1950s to the point that he ceased directing graduate students in chemistry and made history of chemistry his principal research. In 1957 Ihde was given joint appointment as Professor of Chemistry and History of Science and became actively involved in department affairs. Eventually the department gave joint appointments to all the university's historians of medicine, pharmacy, and technology and to its history of science bibliographer; by 1967 four members had their primary appointments elsewhere: Aaron Ihde (Chemistry), Glenn Sonnedecker (Pharmacy), Nicholas Mani (History of Medicine), and John Neu (Memorial Library). Joint appointment made formal cooperation possible, particularly in developing the graduate program.

Further appointments were made after Marshall Clagett was chosen director of the university's new Institute for Research in the Humanities in December 1958. Clagett's reduced teaching in the department made room in 1960 for William Stahlman, a student of Greek and pre-Greek mathematical astronomy, then completing his Ph.D. in history of mathematics at Brown University, with Otto Neugebauer. Stahlman had taught at MIT and Harvard and, although he had not yet completed his doctorate, he was given tenure at Wisconsin. Upon his arrival the course on early science was divided into halves, with Clagett teaching science in the Middle Ages and Stahlman science in antiquity. In 1963 a historian of modern science, Robert Siegfried, who had taught general science at several universities since receiving the department's first doctorate, was appointed; his research focused upon the chemical revolution. Siegfried stepped into the chairmanship, which he held nine years. Finally, in 1964, an epoch for the history of science at Wisconsin came to an end when Marshall Clagett accepted a professorship at the Institute for Advanced Study. Failing at first to attract a new medievalist, in 1965 the department added Victor L. Hilts, a historian of quantitative methods and the social sciences from Harvard. In 1967 David C. Lindberg, a historian of medieval science with a specialization in medieval optics, joined the department. Lindberg had taken his doctorate at Indiana with Edward Grant, one of Clagett's own former students at Wisconsin.[57]

One area not fully covered during the 1960s was American science; ironically, for the university was renowned for scholarship in American history and could

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either as "nonsense" or as not being real problems in the history of science; Hist. Sci. Dept. files. The Institute produced one other legacy: the "Midwest Junto," founded to bring increased visibility to history of science in the Midwest and encourage graduate students at Midwestern universities.

[57] "Clagett named to New U.W. Post," in *Capital Times* (Madison), 6 Dec. 1958; also Hist. Sci. Dept. files. The Humanities Institute was established by the regents in May 1958 and began operations in September 1959; its goal was to allow Institute professors to devote nearly full time to research. In the early years the departmental chairmanship was held by Clagett and Stauffer. Later Hiebert was chairman for several years and Stahlman, who suffered from serious illness, was chairman briefly. The most recent chairmen have been David C. Lindberg, Victor L. Hilts, and Daniel M. Siegel.

logically have become a major center for the history of American science. The History of Science Department considered appointments in the history of American science to be the responsibility of the History Department. The historian Merle Curti, who had supported the reactivation of the History of Science Department, remained deeply interested in science as an aspect of American intellectual history. The History Department supported several appointments in American science: it gave appointments to John Greene (1952–1956) and Charles Rosenberg (1961–1963), and in 1966 it failed at an attempt to lure to Wisconsin a distinguished historian of American science then located on the West Coast.

By the 1960s the History of Science Department began to be as well known for contributions to the history of modern physical and chemical sciences as it had been in the 1950s for medieval science. Erwin Hiebert's special interest was the history of thermodynamics, and through Hiebert the name of Ernst Mach, the nineteenth-century energeticist and positivist, was frequently heard at departmental gatherings. When Robert Siegfried came in 1963, he made Humphry Davy, the early nineteenth-century British chemist, equally familiar. During the 1960s Aaron Ihde began research into the history of biochemistry, a subject of investigation appropriate both to Ihde's own background as a food chemist and to the major role played by Wisconsin in developing the concept of trace nutrients and vitamins. Hiebert introduced a course on physical science and thought in the nineteenth century, and in 1963 Ihde expanded history of chemistry to a two-semester sequence; lack of a suitable textbook for twentieth-century developments led Ihde to publish a new history of chemistry, which devoted ten chapters to events after 1900.[58]

Historians of science at Wisconsin valued their close relationships with university scientists and believed that the professionalization of their own discipline must not lead to separation of history of science from science itself. That belief was made explicit in a letter that five department members sent to the *Scientific American* in 1966. A review article in the *Scientific American* by the Cornell University historian of science L. Pearce Williams had argued that in the future the best history of science would be written by professional historians rather than by scientists with a side interest in history. The five Wisconsin historians of science maintained that scientists themselves must also continue to write history and that "many fundamental historical problems can hardly be formulated without the kind of knowledge about science that comes from inside."

> The history of science, it is true, must not deteriorate into a trivial surface examination of the growth of science in terms of its accomplishments. It must also attempt to understand in depth the process of change and the conceptual, methodological and institutional interaction with the larger social and intellectual environment. To assume that this can be accomplished without the help of scientists is unrealistic. Like anything else worth studying, the history of science can be properly viewed from many prospects, each yielding a partial but comprehensible portion of the ever growing totality. These must include the perspective of the practicing scientist. Indeed, many fundamental historical problems can hardly be formulated

[58] Aaron J. Ihde, *The Development of Modern Chemistry* (New York: Harper & Row, 1964). See Ihde, "History of Chemistry" in *Teaching*, ed. Kauffman (cit. n. 42). Hiebert's "The Development of Physical Science and Thought in the 19th century" was expanded in 1960 to two semesters.

> without the kind of knowledge about science that comes from inside. Scientists can help historians, philosophers and sociologists of science not only to preserve the major documents but also to understand their meaning within the framework of problems worthy of study and analysis.[59]

Such sentiments did not preclude attention within the department to issues outside science narrowly defined. Erwin Hiebert, who was particularly sensitive to the philosophical implications of modern physics, examined the use of thermodynamic concepts by literary and theological writers; he also wrote a volume that discussed the atomic bomb.[60] Most notably, however, Aaron Ihde took strongly proconsumerist and proenvironmentalist positions in the 1960s that were soon reflected in his historical concerns. Ihde's convictions put him at odds with Wisconsin agribusiness interests when the publication of Rachel Carson's *Silent Spring* in 1962 warned of the dangers inherent in use of the insecticide DDT. When the university's entomologists joined forces with the pesticide industry to brand Carson an ill-informed "journalist" ignorant of science, Ihde stated publicly: "I'm of the opinion, the same as Miss Carson, that pesticides have done more harm than good."[61]

As the number of departmental faculty increased between 1957 and 1967, so too did the number of graduate students. Between 1952 and 1957 six doctorates were awarded in history of science by the mechanism of the joint degree: two with Chemistry, two with Pharmacy, and two with History. One committee degree, an arrangement by which several faculty members supervised and gained graduate school approval for an individualized doctoral program, had also been awarded. Steps towards departmental expansion (and perhaps the prestige of holding the Institute for the History of Science) gained graduate school approval in the spring of 1958 for the department to offer a Ph.D. in history of science without the necessity for a joint degree.[62] The practical impact of this approval was principally upon the Ph.D. preliminary examination: it was no longer necessary for history of science students to take partial prelims in another department. The department did not intend, however, to make it easy for students

[59] *Scientific American*, September 1966, *215*:16; the letter was written by Robert Siegfried and signed by Erwin N. Hiebert, Robert Siegfried, Aaron J. Ihde, W. D. Stahlman, and Victor L. Hilts. L. Pearce Williams, in criticizing the shortcomings of J. D. Bernal's *Science in History* (*Scientific American*, June 1966, *214*:8), had written, "The history of science is a professional and rigorous discipline demanding the same level of skills and scholarship as any other scholarly field. It is time for the scientist to realize that he studies nature and others study him. He is no more nor no less competent to comment on his own activities and the activities of his fellow scientists than is the politician. Critical political history is rarely written by the politician and the same is true of the history of science."

[60] Erwin N. Hiebert, *The Impact of Atomic Energy* (Newton, Kansas: Faith and Life Press, 1961). This book resulted from a discussion in Sept. 1958 with the Committee for Social Responsibility of the General Conference Mennonites of North America.

[61] "The Uproar Over 'Silent Spring'! But 'Eminent Scientists' at U.W. Acclaim Rachel Carson's Work as Important and Long Overdue," in *Capital Times*, 21 Jan. 1963. The uproar was precipitated in November 1962 when six university scientists, including Ihde, supported Rachel Carson in a broadcast on the university radio station. See also Alderfer, interview of Ihde (cit. n. 42), p. 12. Ihde's own major professor, Henry A. Schuette, had pointed the way to Ihde's consumerism by denouncing the kinds of things that he believed were happening to consumers when teaching a course on analytical methods for detecting food contaminants and adulterants.

[62] Clagett to C. A. Elvehjem, 31 Oct. 1957, Hist. Sci. Dept. files; "Proposed Requirements for the Ph.D. Degree in the History of Science," Graduate School Document 46, 24 Apr. 1958.

without some advanced work in science to pursue a graduate degree in history of science. Applicant transcripts were scrutinized carefully for evidence of adequate scientific preparation and during the 1950s and 1960s several potential graduate students—including a few later to distinguish themselves in the discipline—were dissuaded from enrolling at Wisconsin when they learned that they needed more science.[63] Actually, many entering students already had a master's degree in science, and for this reason joint-degree programs with science departments remained popular even after 1958. Many history of science graduate students also met their doctoral minor requirements by coursework in science.

Although the first doctoral dissertations in history of science were fairly evenly distributed between medieval and modern subjects, after Clagett left for the Institute of Advanced Study, most dissertations had a modern focus. There were several theses on early modern biology and natural history, but the most popular areas were the history of modern physics and chemistry. Erwin Hiebert became the department's most prolific dissertation director, followed closely by Aaron Ihde. Hiebert's students most often investigated the conceptual development of nineteenth- or early twentieth-century physics or mathematics, examining the contributions of such figures as James Clerk Maxwell, Rudolph Clausius, Arthur H. Compton, and Henri Lebesque. Ihde's students studied the development of modern chemical and biochemical concepts; by the end of the 1960s Ihde's interest in applied chemistry manifested itself in theses on the interrelationship of chemistry and the photographic industry, the role of American university chemists in World War I war gas research, and insecticide residues as a public health problem before the DDT era.[64]

The Department's expansion of its graduate program during the 1960s mirrored the experience of many other programs at the university. From 1958 to 1968 graduate-student enrollment in all fields combined at the university of Wisconsin increased at the rate of approximately 10–12 percent per annum. Total graduate-student enrollment peaked in the academic year 1967–1968 (although 1975–1976 saw the largest number of graduate degrees awarded).[65] For history of science similar trends yielded impressive statistics: between 1947 and 1965, Wisconsin granted twenty-seven doctorates in the field; during the next five years, it awarded thirty. The department's most productive year was 1969, when seven of its students received their doctorate. During the peak years 1968–1973, a total of one sixth of all Ph.D.s granted in history of science in North America were from the University of Wisconsin.[66]

[63] Ironically, two of those who went elsewhere for their graduate studies in part for this reason, David C. Lindberg and Ronald L. Numbers, eventually became faculty members of the Department.

[64] Hiebert: Joan Bromberg, "Maxwell's Concept of Electric Displacement"; Edward E. Daub, "Rudolph Clausius and the Nineteenth Century Theory of Heat"; Roger Stuewer, "The History of the Compton Effect"; Thomas Hawkins, Jr., "The Origins and Early Development of Lebesque's Theory of Integration." Ihde: Reese Jenkins, "Some Interrelations of Science, Technology, and the Photographic Industry in the 19th Century"; Daniel P. Jones, "The Role of University Chemists in Research on War Gases in the United States during World War I"; James Whorton, "Insecticide Residues on Foods as a Public Health Problem: 1865–1938."

[65] "Trends in Graduate and Undergraduate Degrees in L&S and Elsewhere in UW—Madison," prepared by Letters and Science Dean's Office, 1980. "For the last two years, total graduate enrollment on the Madison campus has remained stable, after nearly a decade of expansion at the rate of 10–12% per annum"; Graduate School Dean Robert M. Bock to Graduate Departments and Programs, 17 June 1970.

[66] By comparison with figures given in *Report on Undergraduate Education in the History of Sci-*

Table 1. History of science dissertations at the University of Wisconsin (1952–1983): distribution by general area and date of completion

	Antiquity, Middle Ages, and Scientific Revolution	Modern mathematics, physics, and chemistry	Modern biology, medicine, and social science	Total
1952–1954	2	2	1	5
1955–1959	2	2	1	5
1960–1964	2	7	2	11
1965–1969	3	15	7	25
1970–1974	6	16	3	25
1975–1979	6	6	3	15
1980–1983	1	4	4	9
Total	22	52	21	95

THE ERA OF LIMITS (1970–1983)

The Russian Sputnik was launched in 1957, and in July 1969 American footprints were set on the moon; the department's period of greatest expansion therefore coincided exactly with the race into space. In part the interest in history of science during the 1960s was due to national belief in the value of science and technology; in part it simply reflected the overall expansion of academia. From the mid-1960s onward the Vietnam war and the associated criticism of established institutional values had similar repercussions. The University of Wisconsin was a focus for antiwar activism, culminating in the bombing of the university's Mathematics Research Center in August 1970. Some members of the state legislature developed a suspicious, if not openly hostile, attitude towards the university that may have adversely affected its budget. At the same time, demographic trends pointed towards reduced enrollment in the years ahead. By 1970 the era of limits had begun. After 1967 no appointments to the History of Science Department were made from the budget of the College of Letters and Science, except for faculty replacement. In 1970 there was even a fleeting fear that the department might be reduced. That year another epoch for the department came to an end when Erwin Hiebert accepted a Harvard position. Subsequently Chancellor Edwin Young mentioned on the "Campus Report" TV program that budgetary limitations meant that the university could not replace a professor "from a small department [who] was recently given an offer by Harvard."[67] The vacancy in the history of the modern physical sciences was nonetheless filled by Daniel M. Siegel. Siegel had taken a doctorate in physics with Luis Alvarez's high-energy-physics group at the University of California, Berkeley, before pursuing graduate study in history of science at Yale.

ence, Table II, submitted by the Committee on Undergraduate Education of the History of Science Society (December 1975), p. 50.

[67] Hist. Sci. Dept. minutes, 17 Apr. 1970.

The era of limits did not imply no growth, for the membership of the department was not confined to faculty paid by the College of Letters and Science. In the early 1970s the advantages of having historians of science distributed throughout the university became particularly apparent. The Pharmacy School brought the department one additional member. In 1969 John Parascandola, who had earned his doctorate at Wisconsin under Aaron Ihde, joined the history of pharmacy program. Parascandola was made a member of the History of Science Department in 1970 and remained until becoming director of the History of Medicine Division of the National Library of Medicine in 1983.[68] Finally, before budgetary problems caught up with the university's professional schools, a desire to add a humanistic dimension to the education of physicians and engineers provided academic homes for several additional historians of science, in the Medical School and the College of Engineering.

Although plans had been laid in the mid-1950s for an enlarged History of Medicine Department, they remained in abeyance for several years after Ackerknecht's departure in 1957, and the course on history of medicine required of second-year medical students was taught by a parade of visiting German medical historians. The years of uncertainty were brought to an end with the appointment in 1963 of Nicholas Mani, a Swiss historian of medicine who remained at Wisconsin until accepting the directorship of the Institute for the History of Medicine in Bonn in 1971. Mani recognized that the History of Medicine Department had gone into "hibernation," but his own plans for expansion remained undeveloped.[69] In 1971 Guenter Risse, who believed that history of medicine had an important role to play in the humanistic education of physicians, was appointed to the history of medicine position. Risse possessed an M.D. from the University of Buenos Aires and a Ph.D. in history from the University of Chicago. The requirement that medical students complete a course in history of medicine had been abolished in 1968, but Risse laid plans for a series of elective courses for medical students as well as undergraduate offerings.[70] In 1974 Ronald L. Numbers joined the History of Medicine Department as a historian of American medicine, and in 1975 Judith W. Leavitt received a faculty appointment as a historian of American public health. Risse's own research interests ranged from Egyptian medicine to the present, with a special focus upon eighteenth-century medical theory. Unlike older medical historians—but like an emerging breed of younger historians of medicine—neither Numbers nor Leavitt had an M.D. degree but came to their field via a doctorate in history. Risse, Numbers, and Leavitt all received joint appointments with the History of Sci-

[68] In the early 1960s Ernst W. Stieb had assisted Glenn Sonnedecker, but he had left Wisconsin in 1967. History of pharmacy in Madison continued to be represented by the American Institute of the History of Pharmacy. Sonnedecker and Parascandola both served as director of the AIHP, which had a symbiotic relationship with the university's program in history of pharmacy. By 1984 the annual budget of the AIHP had increased to $185,000. See also John Parascandola, "Pharmaceutical History for the Pharmacy Student," in Jerome J. Bylebyl, *Teaching the History of Medicine at a Medical Center* (Baltimore: Johns Hopkins Univ. Press, 1982), pp. 78–86.

[69] Quoted in Risse, "Wisconsin Chair in Medical History" (cit. n. 38), p. 136.

[70] Guenter Risse, "The Role of Contemporary Medical History: A Brief Summary," *Wisconsin Medical Alumni Quarterly,* Fall 1971, No. 4, pp. 6–7. See also Risse, "The Role of Medical History in the Education of the 'Humanist' Physician: a Re-evaluation," *Journal of Medical Education,* 1975, *50*:458–465.

ence Department. As a member of that department, Ronald Numbers began teaching a course on the history of science in America and directing dissertations on the history of American science.

Avocational interest in history of technology on the part of engineers never led, as it had in medicine and pharmacy, to inclusion of historical courses in the curriculum of the College of Engineering. One longtime member of the engineering faculty, Thomas J. Higgins, was well read in the history of electrical engineering, but before 1970 activity in history of technology at Wisconsin had been almost entirely restricted to Aaron Ihde's interest in industrial chemistry. During the late 1960s, however, the environmental movement and the Vietnam war led critics of the engineering profession to urge that engineering education pay more attention to human values. In the early 1970s the College of Engineering appointed two historians of technology to its Department of General Engineering to teach engineering majors courses with a humanistic emphasis. Edward E. Daub, a recipient five years earlier of a Wisconsin Ph.D. in history of science, arrived in 1971 and was joined in 1973 by one of his own former dissertation students, Terry S. Reynolds. Both became members of the History of Science Department. Reynolds assumed major responsibility for the courses in history of engineering upon his arrival, while Daub, who had once been a Presbyterian missionary to Japan, increasingly devoted his attention to courses in technology and human values. In 1983 Reynolds left to become director of the program on science, technology, and society at Michigan Technological University.

The History of Science Department made one appointment in the late 1970s independently of other units of the university. The history of biological science had long been represented only by Robert Stauffer's interest in the history of evolutionary biology. The department had actually received authorization in the late 1960s to appoint a second historian of biology, but this authorization was withdrawn in 1969 before it could be exercised.[71] The new appointments in history of medicine and pharmacy, however, renewed the desire to strengthen the department's efforts in history of biology. In 1975 William Stahlman died, and instead of seeking a replacement in ancient science, the department decided to wait until Stauffer's impending retirement might make possible the appointment of an established historian of biology. In 1978 Stauffer reduced his teaching to half-time in anticipation of retirement, and the department appointed William Coleman, a historian of biology then at Johns Hopkins.

Central issues for the department during the 1970s and early 1980s were graduate-student admission and placement, the structure of the graduate program, and the development of new courses. Concern developed as early as 1969—the year when seven Wisconsin students completed doctorates in history of science—that employment opportunities for historians of science might diminish in the future. Although prospective graduate students were warned about employment difficulties, no quota was placed upon the number of graduate students admitted during the 1970s. In fact, as the department became more receptive to students without advanced study in science, admission requirements became

[71] Hist. Sci. Dept. minutes, 7 Nov. 1969.

more flexible. The number of graduate students enrolled reached a peak of just over forty in the mid-1970s and declined to slightly over thirty by the beginning of the 1980s. Doctorates awarded tapered off during the 1970s to an average of approximately three per year.

Changes in the graduate program resulted in part from the increasing diversity of the department's faculty and in part from changes in the profession itself. During the 1970s no single approach to history of science dominated in the department as the history of medieval science had during the 1950s or the history of modern physics and chemistry had during the 1960s. Joint-degree programs between History of Science and science departments remained common, and a new joint Ph.D. program between Philosophy and History of Science was formalized. History of modern physics and chemistry remained favorite dissertation areas, but they were joined in popularity during the early 1970s by the history of medieval science and after 1980 by the history of the biological and medical sciences. The most profound change, however, was the department's recommendation to its graduate students that they take a substantial amount of general history. This recommendation reflected not a new departmental philosophy of explanation (e.g., one relying on external rather than internal factors) but rather the perception that increasing numbers of historians of science identified professionally with the historical rather than the scientific community and by the related perception that academic employment for historians of science was increasingly to be found in departments of history rather than departments of science.[72]

Undergraduate courses also changed during this period. In 1964 a curriculum change meant that the department's introductory history of science courses would provide humanities credit rather than, as they had since 1946, natural science credit. Fears that enrollment in the courses (renumbered History of Science 201–202) might suffer from the new policy proved unfounded.[73] The same combination of factors that brought graduate students to the department during the late 1960s (which ironically included the criticism of science implicit in debates over the environment and the Vietnam War) may also have made history of science popular among undergraduates. In the 1970s the department took steps to decrease dependence upon History of Science 201–202 and redress the balance between undergraduate and graduate teaching: it lowered the course number of advanced courses other than seminars so as to attract more undergraduates, and it introduced new undergraduate courses, some aimed at freshmen and sophomores and others on topics of contemporary concern addressed primarily to upperclassmen. Robert Siegfried began teaching a popular course entitled "Newton, Darwin, and Freud," Daniel Siegel introduced an introductory course on science in the twentieth century, Victor Hilts taught a survey on the sciences of man, Aaron Ihde and Victor Hilts instituted a course that focused upon the impact of applied science, and Robert Siegfried and

[72] One aspect of this is discussed in Ronald L. Numbers, "The History of American Medicine: A Field in Ferment," *Reviews in American History*, 1982, *10*:245–263.

[73] In fact, the opposite occurred: an enrollment spurt that saw total combined enrollment in History of Science 201–202 double from 527 in the academic year 1964–1965 to a peak of 1212 in 1969–1970.

David Lindberg developed "History of Pseudo-Science and the Occult."[74] With the increased offerings the percentage of the department's enrollment in the original two introductory courses perforce declined, but History of Science 201 (renamed "Origins of Scientific Thought") remained popular and often filled to a capacity dictated by funds available for the employment of teaching assistants.

Two other developments also reflected departmental interest in undergraduate teaching during the early 1980s. The variety of history of science courses available to undergraduates made possible a restructuring in 1980 of the department major. Requirements, which included substantial course work in science, had remained largely unaltered since 1948, but the new major was designed with greater flexibility, to appeal to preprofessional students and those seeking a general liberal education. In 1981 departmental faculty also lent support to the university's program in Integrated Liberal Studies. The ILS program, which dated from 1948, was designed to introduce participating freshmen and sophomores to a coherent set of courses on culture, society, and science; it had initially involved many of the same faculty figures who backed history of science.[75] Aaron Ihde had taught a course entitled "Physical Universe" for ILS from 1948 until his retirement in 1980, and throughout the years this course provided teaching opportunities in general science for a considerable number of history of science graduate students. Upon Ihde's retirement the dean's office challenged the existence of ILS, in part on the grounds that faculty were no longer willing to participate: in response Daniel Siegel created a new ILS course and David Lindberg began teaching "Origins of Scientific Thought" for ILS credit. The department thus found itself in the 1980s not only deeply engaged in its graduate teaching, but also carrying out a mission of undergraduate general education much like that contemplated when the department was created before World War II.

CONCLUSION

History of science at the University of Wisconsin has developed in some respects as a microcosm of the discipline as a whole. Eminent scientists with a love of rare books and an avocational interest in history led the way. George Sarton's promotional efforts had their effect before World War II. After the war, history of science at Wisconsin benefited from the optimism of a generation that had reason to believe that bigger would be better; later it felt the impact of an era of limits that curtailed the university's budget. Meanwhile the university

[74] The course on the occult brought the department some unaccustomed headlines; see "The Occult: A Substitute Faith," *Time,* 19 June 1972; "Credence Given Occult Here 'Boggled' Mind of Professor," *Capital Times,* 29 Sept. 1972; David Mutch, "Occultism on Campus," *Christian Science Monitor,* 13 Oct. 1972; Mary Nohl, "A Couple of Disenchanters: From Astrology to ESP It's a Lotta Vaudeville, Two Scientists Tell Their Students," *Wisc. Alum.,* Mar. 1973, pp. 17–19; "Voodoo U," *Newsweek,* 9 Apr. 1973. In Sept. 1972 a questionnaire revealed that 18% of 321 students beginning the course believed in astrology, 74% in extrasensory perception.

[75] Samuel Kellams, *ILS: An Analysis of a General Education Program at the University of Wisconsin* (diss. Univ. Wisconsin, 1971). ILS was championed by Mark Ingraham, and its first instructors included Aaron Ihde, Robert Reynolds, Lowell Noland, and C. Leonard Huskins, all associated in some way with the development of history of science. During the 1950s Erwin Hiebert and during the mid-1960s Robert Siegfried taught in the ILS Program.

participated in the establishment of history of science as a recognized scholarly profession.

History of science at Wisconsin, however, had its distinctive aspects. In 1941 the university was the first to establish a department, and by 1947, in the estimation of Jacques Barzun and perhaps others as well, Wisconsin was the only university taking seriously its "cultural responsibility" to the history of science. No period was, in fact, more important for the institutional shaping of history of science at Wisconsin than the eighteen months between January 1946 and June 1947. During that brief interval five Wisconsin faculty members began their involvement with the history of science: plans were laid for a two-member history of science department able to support graduate students and for history of medicine to be taught in the Medical School and history of pharmacy in the Pharmacy School. Concurrently the university began acquiring rare books in history of science. To a perhaps surprising degree, arrangements for history of science at Wisconsin still reflect these actions taken in 1946–1947.

The profession of history of science was extraordinarily fortunate that an awakening to the value of history of science coincided in the postwar years with the beginnings of expansion in academia. At Wisconsin, as elsewhere, a knowledge of history of science seemed particularly important during the first years of the atomic age, but in part because of previous developments the university was uniquely poised to capitalize institutionally upon this interest. History of science at the University of Wisconsin has fared well since 1947. But it is difficult to imagine another conjunction of circumstances quite so propitious as that which existed almost forty years ago when plans were made to make the university "quite a center for history of science."