

Companions in Zealous Research, 1886–1986

Michael M. Sokal

Lacking an established aristocracy, Americans have always formed associations of all kinds, especially during the second half of the nineteenth century. Many social fraternities had emerged before the Civil War, and the postwar period saw professors and students build a rich variety of professional and honor societies, each trying to gain for its members and its field some special distinction. Even Phi Beta Kappa, whose first chapter had been founded in 1776, lacked a firmly established national organization—the United Chapters—until 1883. The late nineteenth century also saw engineering students found Tau Beta Pi and medical students organize Alpha Phi Omega.

Among those who felt the need for a new honor society was Frank Van Vleck. In 1886, Van Vleck was a young instructor in Cornell's Sibley College of Mechanical Engineering. As a student at Stevens Institute, he had seen both the limitations of traditional classical education—emphasizing the ancient world and ignoring even modern languages, history, and literature—and the growing dissatisfaction with such an education felt by many humanists. At Cornell, Van Vleck talked most fully about his views on education with William A. Day, a Sibley senior: "He and myself were just before the '86 Commencement slowly toiling up the hill from town when he suggested to me the idea of a scientific Phi Beta Kappa. The thought of it at once impressed me, and we then in a way reviewed the field and the methods of organization. Together we went to my room, and before we parted we had the whole plan of organization formulated and a definite plan of campaign outlined."

Aided by historian friends, Van Vleck and Day adopted a pair of Greek letters and a motto, Spoudon xynones: "Companions in zealous research." Day and

William H. Riley, another early companion, soon left Cornell, but Van Vleck called together six other Sibley College graduate and undergraduate students. Through the summer and fall the seven young men wrote their society's constitution and planned its future, even contemplating an eventual nationwide expansion. By the time of the 1887 commencement, the charter group had enacted governing documents, elected new members, and even extended its influence beyond the campus. As Van Vleck later remembered, within a year after his walk with Day, the Society had "achieved a success which has almost astonished the initial projectors."

*Controversies over its
place in the scientific
community and in
society at large have
distinguished Sigma Xi's
first hundred years*

Interpreters of these events have stressed Van Vleck's goal of a "scientific Phi Beta Kappa." But another purpose was probably never far from the founders' minds. The type of engineering taught at Sibley College in the 1880s represented a new approach to the subject, which had been gradually appearing in the mid-nineteenth century. Analytic approaches to engineering, rooted in mathematics, precise testing, and

careful experimentation, were replacing shop apprenticeship traditions, based on rules of thumb, the methods of the past, and cut-and-try techniques. The Sibley-trained engineer thus had more in common with the academic scientist than he had with the machinist and foreman. Though the "school culture," supported by the newly formed professional engineering societies, eventually swamped the "shop culture," the outcome of the competition was still in doubt in the 1880s. Responding to the criticisms of traditionally trained engineers, younger engineers like Frank Van Vleck sought ways to reinforce the standing of their school culture. How better to do so than by establishing a Greek-letter (and hence clearly college-oriented) honor society for their subject?

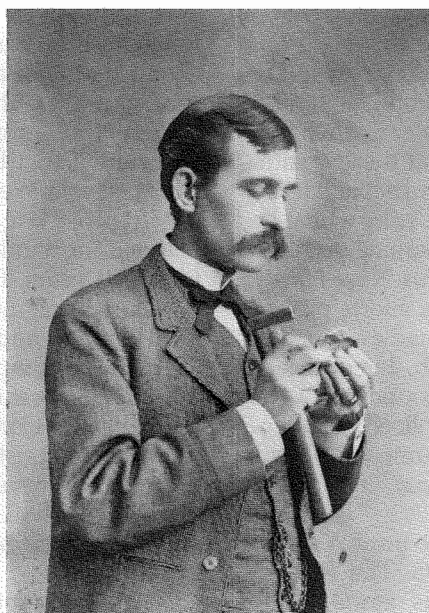
As Van Vleck always emphasized, however, the founders looked beyond engineering and saw Sigma Xi providing recognition in all scientific fields. For them, Tau Beta Pi was much too narrowly focused. Their efforts were soon noticed by a man who probably did more to shape Sigma Xi than any other: Henry Shaler Williams, distinguished geologist and professor at Cornell.

Throughout the 1880s, Williams felt the same impulses that led others to found professional organizations, and he participated in the founding of the Geological Society of America in 1888. His earlier plans for a

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Frank Van Vleck



Sigma Xi was founded at Cornell's Sibley College of Mechanical Engineering by a group of students and one junior faculty member, Frank Van Vleck (left). The young men intended not only to establish an honor society like those already existing in other fields, but also to promote a new, more academically oriented type of engineering education in contrast to the older shop-oriented tradition. The fledgling organization received its first support from an older member of the science faculty in the person of Professor Henry Shaler Williams (middle). Having already tried unsuccessfully to establish an honor society for science students, Williams was pleased to merge his interests with those of Sigma Xi's founders. He soon became the Society's chief mentor, serving

student honor society had failed, and in 1886, when he heard of Sigma Xi's initial successes, he quickly asked its founders to merge their interests with his. They gratefully accepted; after all, he was the first professor actively interested in their work, his standing as a scientist would help them reach out beyond engineering, and his stress on "modern" science supported their goals. They elected Williams to membership in February 1887 and soon thereafter chose nine other new members, including four nationally known professors: mechanical engineer Robert H. Thurston, botanist William R. Dudley, entomologist John H. Comstock, and civil engineer Charles D. Marx. That May, the Society elected Williams president.

An active leader, Williams devoted much thought to defining Sigma Xi's purpose. All agreed that it was an honor society, but what exactly did membership honor? Van Vleck and the other founders had emphasized the Society's fraternal aspects, choosing a name and motto that stressed companionship and—despite attempts to avoid the more notorious characteristics of Greek-letter societies—allowing three negative votes to blackball a proposed member. The first constitution's membership qualifications called simply for "prominence in some scientific or engineering branch of study, or . . . a capability of achieving such prominence."

In Sigma Xi's first presidential address, delivered in June 1887 as the Cornell chapter inducted its first initiates, Williams criticized these criteria and attempted to

as first elected president of the Cornell chapter and leader of the growing organization until the turn of the century. Sigma Xi elected women to full membership as early as 1888, when five women were among the new members. This action both promoted the interests of women and made their research more available to the scientific community. Anna Botsford Comstock (right) was the wife of the noted Cornell entomologist John Comstock; her field studies of insects were important in their own right, and they also did much to supplement her husband's entomological classifications. (Samuel C. Williams Library, Stevens Institute of Technology; Yale University Archives, Yale University Library; Department of Manuscripts and University Archives, Cornell University Libraries.)

spell out more appropriate membership qualifications. Entitled "The Ideal Modern Scholarship," Williams's talk emphasized both the modernity of Sigma Xi's interests and his belief that the Society should focus on active research rather than simply on the acquisition of knowledge. Throughout his presentation, he implicitly distinguished between Sigma Xi's concern with present and future achievement and Phi Beta Kappa's focus on the past and thus defined the ecological niche that he saw Sigma Xi filling. The chapter printed Williams's address as a statement of principle, clarifying what membership in Sigma Xi meant and establishing research as its distinguishing characteristic.

As early as 1887, then, with a membership of almost fifty, the Society was well established at Cornell. From the beginning, however, all looked beyond Ithaca and saw their group as the first chapter of a nationwide society, and personal ties soon led to the founding of new chapters. By June 1887, new chapters had been formed at Rensselaer Polytechnic Institute (of the eight Sibley students who had founded the Society, three were graduate students who were RPI alumni); nearby Union College; Stevens Institute of Technology (Van Vleck's alma mater); and Rutgers College, only a few miles from Stevens. Just as importantly, RPI, Union, and Stevens all offered engineering curricula that broke with the traditional shop culture. Faculty and students at these schools hoped that Sigma Xi would help reinforce their goals, and at such institutions the founders' efforts

at extension—that is, the addition of new chapters—proved most successful.

Efforts to establish chapters at Yale, Harvard, Columbia, Johns Hopkins, Boston University, MIT, and Lehigh, however, all failed. The founders at Cornell had few if any personal ties with individuals at these institutions, most of which lacked engineering curricula. Henry Shaler Williams did have close contacts at Yale, where he had received both undergraduate and graduate training, and he was charged with approaching his New Haven friends about a Sigma Xi chapter. But his efforts proved unsuccessful, and by the end of 1888 he had even begun to pull away from Sigma Xi. His research, his duties as newly elected dean of faculty, and the founding of the Geological Society of America all monopolized his attention. In 1892 Williams left Cornell, to assume at Yale the professorship that James Dwight Dana, his distinguished graduate mentor, had held.

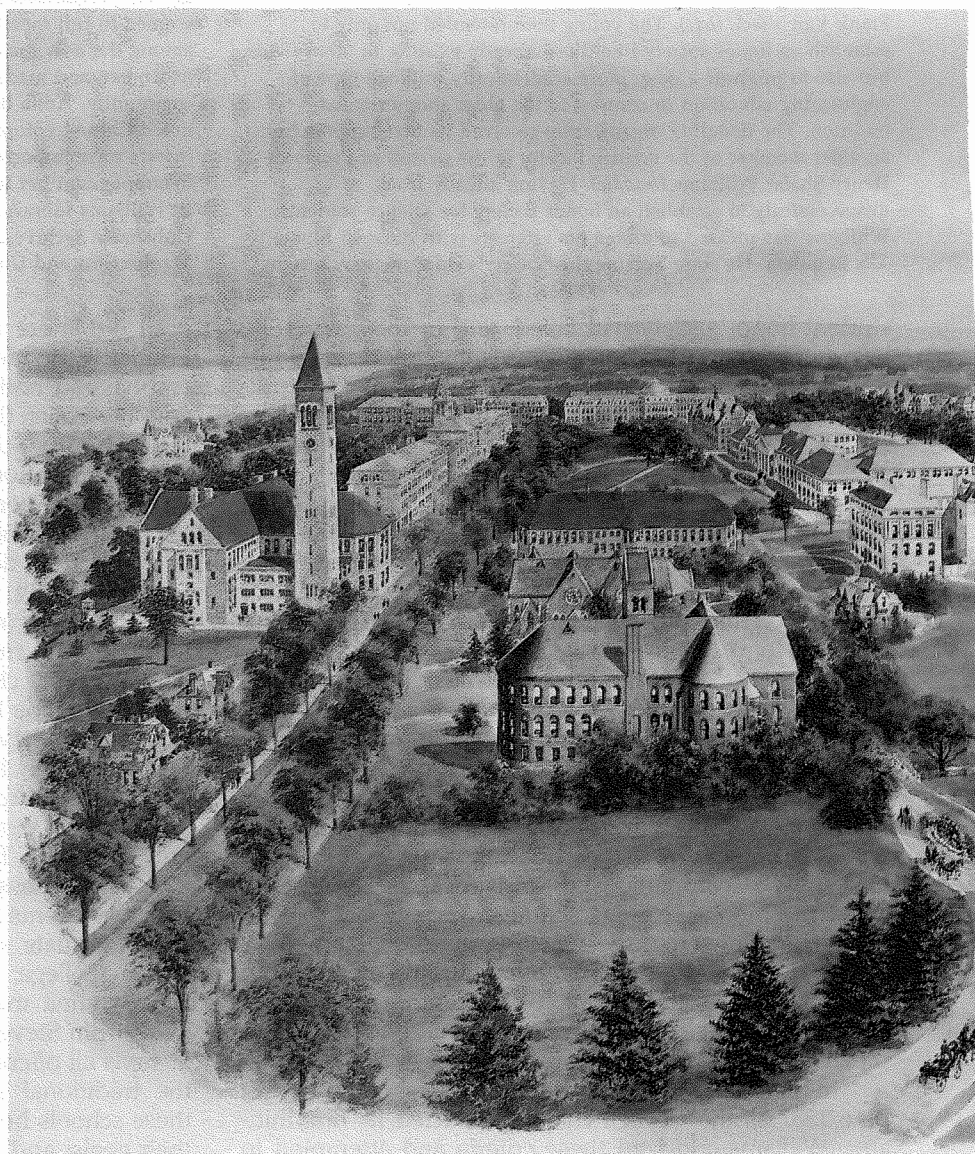
In some ways, Sigma Xi marked time until Williams again became active in its affairs in 1895. The Rutgers and Stevens chapters vanished during this period, not to reemerge until 1922 and 1954 respectively. But in other ways the founders at Cornell did much to secure the Society's niche and solidify its base. Following the spirit of "The Ideal Modern Scholarship," they elected many new members, including, in December 1888, the first group of alumni members: thirty-nine distinguished individuals who had graduated from Cornell as early as 1870, many of whom later organized chapters at other schools. More significantly from a late-twentieth-century perspective, this group included five women, elected on equal terms with their male counterparts. Three—Anna Botsford Comstock, Susanna Phelps Gage, and Harriet Groteclass Marx—were married to eminent Cornell scientists or engineers, but all actively pursued their own scientific work. Sigma Xi thus began performing an important service for both the scientific community and women by helping to open the field to a large group of qualified individuals who had not been able to find a place in it before.

In the following year Edward L. Nichols, a Cornell physicist who had taught at the University of Kansas, helped his former midwestern colleagues to establish the first Sigma Xi chapter outside the East. Western

and midwestern state universities flourished in the late nineteenth century, and though their faculties often did as much science as any others, they generally lacked the reputations of their private eastern counterparts. The Society thus provided professors and students with recognition that they could not find elsewhere, and the Midwest and West proved a fertile field for expansion.

In projecting a nationwide society, the founders had planned for regular conventions, though they held none for seven years. By 1893, the issues facing the Society—particularly membership qualifications, relations among the chapters, and extension—had stirred enough interest for most chapters to send delegates to a meeting in Ithaca. This first convention drafted a new constitution, based on the Cornell chapter's revised document. While the original constitution had stressed the Society's honorary function as its primary goal, the 1893 document emphasized that "the object of this Society shall be to encourage original investigation in science, pure and applied."

The convention also defeated a motion to limit membership to men and established a Committee on



Cornell University was only about twenty years old when Sigma Xi was founded, but it was already an important center of learning and research in science and engineering, among other fields. This view of the campus looks north, with the original quadrangle and Sibley Hall in the left background.

Extension. It instituted a formal organizational plan for the entire Society, which included officers, the authority to assess each chapter for the funds necessary to cover the Society's expenses, and biennial conventions to provide continuity. Having elected Charles C. Brown of Union president and James McMahon of Cornell secretary, the delegates left Ithaca with an optimistic view of the future. The Stevens and Rutgers chapters might have disappeared, but most members felt that, with more than 350 members, the Society was well established.

Building a nationwide society

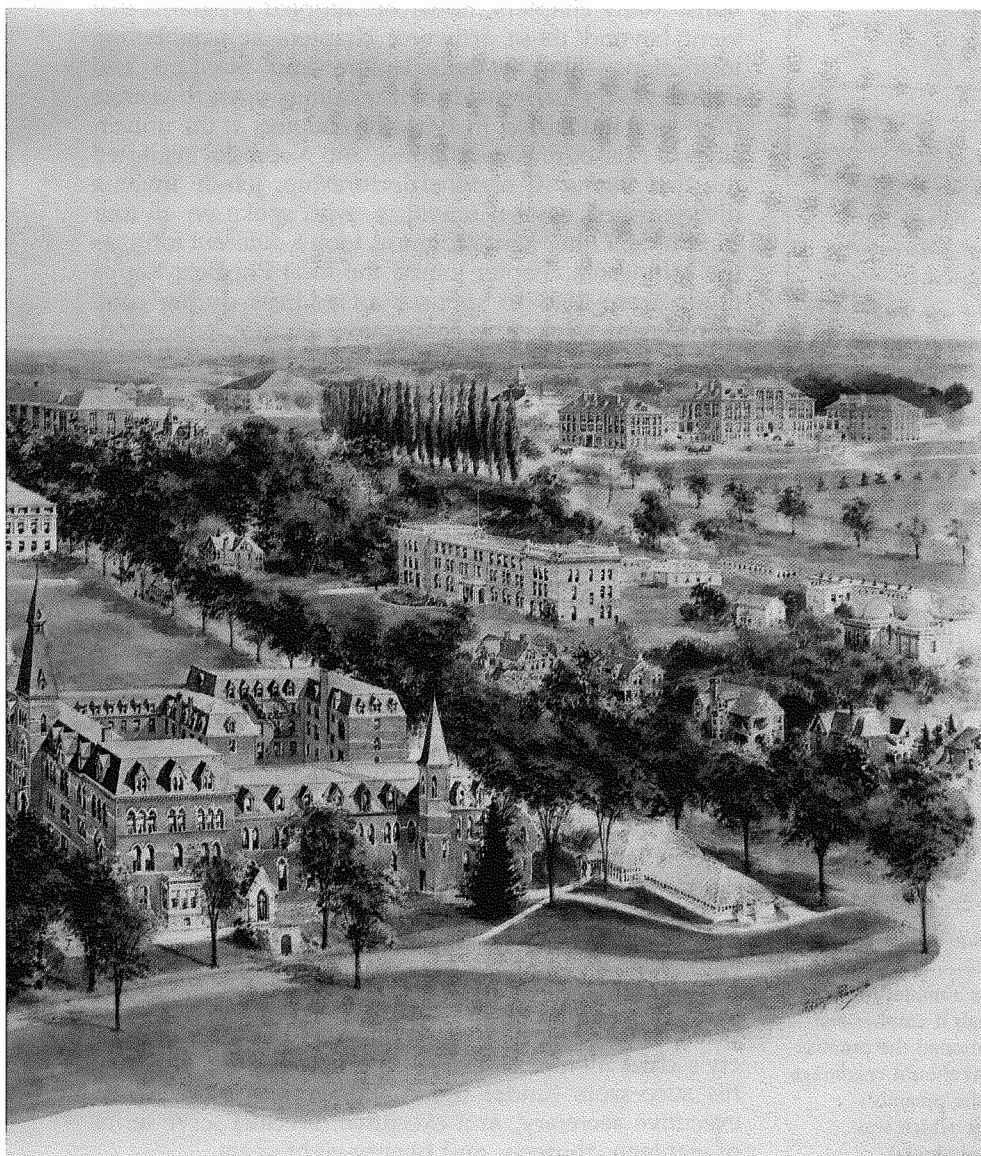
From the time of the first convention, James McMahon and the Committee on Extension remained constantly active. Members elected at Cornell who found themselves teaching elsewhere inquired about extension procedures and, in some cases, petitioned formally for charters. But after the failure of the Stevens and Rutgers chapters, Brown and McMahon feared uncontrolled extension. They thus looked to the Committee on Extension for policy guidance that would go beyond the

constitution's simple "consent of three-fourths of the existing chapters."

The newly formed Yale chapter had appointed Henry Shaler Williams as its representative to the committee. Under Williams's chairmanship, the committee gave the officers what they had sought. Its report to the 1895 convention, which soon rivaled "The Ideal Modern Scholarship" in influence, again stressed "original research" as the Society's focus and urged that future chapters be chartered only at institutions promoting scholarly activity. Williams thus spelled out three formal guidelines for extension: breadth of scientific competence, the existence of an active group of researchers, and, most importantly, "close scrutiny to the facilities and opportunities of the institution for the advancement and encouragement of original research . . . and to the qualifications of its scientific faculty to accomplish these ends." The report also strongly implied that Sigma Xi should go beyond honoring researchers and begin promoting research at institutions that employed its members. The convention adopted the committee's recommendations unanimously, and the report for many years appeared as a constitutional appendix. Once again Williams had helped to shape Sigma Xi, and the delegates elected him president, a position he held until 1901.

Although the report promoted extension, the committee applied Williams's criteria rigorously and rejected several petitions. In other cases involving eastern universities, several groups decided not to pursue their initial inquiries, and Edward Nichols "was struck by the contrast between the pessimistic spirit that prevailed there and the scientific enthusiasm of some of the Western institutions." Before 1900, then, through the efforts of Cornell alumni, active chapters were founded at Minnesota, Nebraska, and Ohio State. At Minnesota, for example, Henry T. Eddy, a graduate of both Cornell and Yale elected to alumni membership in 1888, led the movement for a chapter. As a mathematician interested in structural problems, Eddy was especially pleased to have the Society's stress on scholarship reinforce his efforts at reforming engineering education.

Through the 1890s the Society's membership grew, and by the turn of the century Sigma Xi claimed more than one thousand members. It changed in other ways too, as most chapters dropped the Greek-letter designations the founders had wanted and an 1897 amendment rid the constitution of the three-vote blackball, which, James McMahon reported, "had been sometimes abused."





Preamble

Of stores of dog and learned lore we gain,
 We keep them in the memory of the brain;
 Names, things, and facts,—whate'er we knowledge call,—
 There is the common ledger for them all;
 And images on this cold surface board
 Make slight impression and an soon efface.
 But we've a page, more glowing and more bright,
 On which our friendships and our love to write;
 That there may never from the soul depart,
 We trust them to the memory of the heart.
 There is no damning nor effacement there;
 Each new publication keeps the record clear;
 Warm, golden letters all the tablet fill,
 No loss this book till the heart stand still.

Daniel Webster

Friendship in Science. While those who
 hunt and end in their work are coping with the
 great problems of Nature, let them remember that
 the ties of friendship cannot be investigated, but
 only felt. Let us then join heart and hand,
 forming a brotherhood in science and engin-
 eering. Thus promoting and encouraging by
 their strong personal attachments of friendship,
 the highest and the truest advances in the
 scientific field. To lend aid and encouragement
 to those newer brothers, who likewise laboring in
 the same sphere are aspiring to honored positions
 and in collegiate halls to award an honor, which
 to scientific recipients shall signify "Come up
 higher"

Therefore with their ends and objects, the signers
 of this paper, do hereby agree to lend their
 efforts to the establishment of an organ-
 ization to be publicly known as the Society
of the Sigma Xi

Wm A Day Cornell University '86
 Wm H. Riley Cornell University '86
 Frank Van Hook Stevens Institute of Technology '84
 Wm A. Moseoff Cornell University '88
 E. G. Smith, Cornell University '87
 Chas. B. Wing, Cornell University, '86.
 John Knickerbocker Rens Poly. Inst. '86.
 John J. Bourque Rens Poly. Inst. '86
 Edwin W. Sanderson Rens Poly. Inst. '86

The constitution of the Cornell chapter served as a model for the national organization's first constitution. Although it emphasized the honorary nature of membership, it also mentioned the promise of achievement and thus suggested that Sigma Xi should encourage research. This facsimile of the original draft of the preamble appeared in the *Half Century Record and History*, which was published in conjunction with Sigma Xi's semicentennial.

The Society's large membership and its eight active chapters showed its viability, and many looked to Sigma Xi for honor and recognition. In 1897, for example, Henry Eddy, a member of both honor societies, reported that at Minnesota "Sigma Xi outranks Phi Beta Kappa." In the same year, a professor at Worcester Polytechnic Institute told Henry Shaler Williams that his school "could probably obtain a charter from Tau Beta Pi . . . but . . . would of course prefer Sigma Xi." On the national level, the Council—a body of representatives that replaced the Committee on Extension—regularly considered inquiries and petitions. From 1899, the Society held its conventions at the same time as those of the American Association for the Advancement of Science, then an umbrella organization that did much to coordinate the activities of various scientific societies.

In 1900, three new chapters—at Brown, Iowa, and Pennsylvania—joined the Society, and every year through 1910 saw the admission of one to three new groups. During this decade, most chapters, new or old, met primarily to "discuss scientific subjects," thus providing the promised companionship in research, and to honor professors, students, and alumni of their institutions. Many chapters, however, adopted programs that went beyond these activities: chapters at neighboring institutions—like RPI and Union, and Stanford and Berkeley—regularly held joint meetings open to visitors from local industries. In 1907, the chapters at the universities of Missouri, Kansas, Iowa, and Nebraska instituted the first Sigma Xi regional lectureship, jointly inviting distinguished eastern scientists, who spoke on all four campuses. Other joint programs took a different form, as the Minnesota chapter joined the local Phi Beta Kappa group from 1898 to sponsor an address during commencement week. This cooperative venture, which continued for decades, stimulated scholarship on campus and set a pattern followed at other institutions.

Many other programs might be discussed, but none matched the importance of those supported by the Stanford and Berkeley chapters after the 1906 earthquake. At Stanford, a three-member Engineering Commission—composed of Charles B. Wing (one of the Society's founders), Charles D. Marx (one of the first Cornell faculty members elected), and William F. Durand (Sigma Xi's president thirty years later)—oversaw the reconstruction of the campus. San Francisco faced an even worse situation: rats bred rapidly, and cases of bubonic plague soon appeared. Local politicians, fearing for the region's reputation, tried to suppress discussion of the problem and thus impeded those who wanted to take action. The Berkeley chapter publicized its concerns, led an eradication campaign, prodded public officials to action, and raised funds. Few chapters have done more for their communities.

A major transition in the Society's leadership occurred in 1904, when James McMahon retired as secretary and was succeeded by Henry Baldwin Ward, a Nebraska zoologist, who then served for seventeen years, taking Henry Shaler Williams's place as the Society's chief mentor. Ward set a precedent that has seen his successors (under the changing titles of secretary, executive secretary, and executive director) serve terms of eighteen, thirteen, and twenty-eight years.

Within a year, a member of both Sigma Xi and Tau Beta Pi urged the two societies to merge. Both organizations considered the suggestion seriously, but by 1906 agreed that they had too little in common to be joined. Tau Beta Pi consisted solely of engineers, emphasized honoring undergraduates, rewarded high grades more than research achievement and potential, and jealously guarded its fraternal aspects. Many Sigma Xi members looked down upon the engineering group, while many in Tau Beta Pi apparently thought Sigma Xi pretentious. Those who deliberated the merger, however, respected each other, and in going their separate ways each group wished the other well.

This brief episode had many important long-term implications for Sigma Xi. As an undergraduate honor society, Tau Beta Pi served students well, and many Sigma Xi members thus realized that their society could do more along these lines. To be sure, some chapters regularly elected eligible undergraduates who demonstrated research achievement through, for example, their senior theses. But others rarely elected students, believing that such young individuals could not possibly have exhibited the research potential that the constitution called for. Consequently, serious debates about membership qualifications took place at conventions. Those who argued against electing undergraduates stressed Sigma Xi's role as an honor society, while those who favored election claimed that such early recognition would stimulate students' research interests and thus reinforce the Society's goal of promoting research.

Here then reemerged the frequently raised point of contention as to how the Society should combine its objectives of honor and encouragement. In 1908, the Cornell chapter suggested creating a class of associate or junior members. A Committee for the Revision of the Constitution proposed in 1910 that chapters elect members and associates and that, from the members, the Society at large elect fellows. Heated debate again followed, and at the 1911 convention neither proposal won the two-thirds vote needed to amend the constitution. But the closeness of the thirteen-to-eight vote on associate membership and the handy six-to-fifteen defeat of the proposed designation of fellow suggested that a consensus was near.

The controversy over associate membership was aggravated as the Society's missionary efforts elicited petitions for charters from a wide variety of institutions, many unlike those that already had chapters. Some came from colleges with few science majors, "whose professors in science are as productive in research as such environment ordinarily permits." Even Henry Shaler Williams's Report on Extension, formally inserted into the constitution late in 1911, provided little help in dealing with these applications. From 1910, then, the Council issued no new charters for four years, while the Society as a whole tried to deal with the issue.

At its quarter-century anniversary in 1911, the Society had about 2,000 active members in its twenty-eight chapters. Growth had its costs, however, and those who believed that extension should be slowed complained that members, chapters, chapter officers, and national officers seemed out of touch with each other. Annual conventions, held from 1908, did not really deal with the

[Announcement of the First]

CONVENTION

OF THE

Society of the Sigma Xi

HELD WITH THE

Alpha Chapter, Cornell University

May 17 and 18, 1893

Program

WEDNESDAY, MAY SEVENTEENTH

The convention will assemble for business session at 2:30 p.m. in the Architectural Lecture Room, Lincoln Hall.

THURSDAY, MAY EIGHTEENTH

FORENOON

Second Business Session.

AFTERNOON

Third Business Session.

EVENING

Public meeting in Chemical Lecture Room, at eight o'clock. Address by E. L. Nichols, President, upon

"PHOTOGRAPHY AS AN INSTRUMENT OF RESEARCH"

At the close of the address the delegates and the members of the local chapter will be tendered a reception at the house of Professor Nichols, where the initiation of newly elected members will also take place.

The first convention was held in Ithaca in 1893. It addressed issues that have elicited lively debate throughout the history of Sigma Xi: qualifications for membership, relations among chapters, and ways in which new chapters might be added. This announcement shows that educating members as well as conducting Society business has been a purpose of conventions from the very beginning. (Department of Manuscripts and University Archives, Cornell University Libraries.)

issue, as Sigma Xi still met with the AAAS. This arrangement increased attendance, but other sessions often distracted delegates, and so in his 1911 presidential address, Henry Eddy called for independent meetings.

The problem, however, ran deeper. Chapter officers typically did not coordinate their activities with national policies, and soon after he took office Henry Ward discovered that the Society lacked even an accurate membership roster. He thus undertook the compilation of a *Quarter Century Record and History*, in part to help him with his secretarial duties and in part to help publicize the Society. The confusion that Ward found in trying to make sense of chapter records delayed the volume's publication from 1911 to 1913.

At the root of the problem was the fact that most Sigma Xi members identified themselves more with their chapters than with the nationwide Society. Consequently, though they often knew the chapters' roles, they had little idea of Sigma Xi's larger purpose and often argued

that what had worked for their chapter should work for the whole Society. On its twenty-fifth anniversary, then, Sigma Xi faced a serious crisis; the successful resolution demonstrated the Society's adaptive powers.

Reform and redirection

Sigma Xi resolved the crisis by leading its members to identify themselves more with the nationwide Society and less with their own chapters. That is, it adapted to environmental change, and it did so by creating a new organ, *Sigma Xi Quarterly*. Early in 1913, at the fourteenth convention, former president Samuel W. Williston urged the establishment of a "Quarterly Bulletin," which would, he argued, "create further interest in the Society and increase its usefulness." Many delegates favored the proposal but feared its cost; when Williston offered to serve as managing editor and to cover any deficits, the Society agreed to publish it for at least a year. *Sigma Xi Quarterly's* first issue appeared soon thereafter, in March 1913, and, along with the *Quarter Century Record and History*, helped give the previously isolated chapters a sense of the larger Society.

Unlike its successor *American Scientist*, the *Quarterly* ignored scientific topics in favor of convention proceedings, committee reports, reports of chapter activities, debates about extension and associate membership, and articles by officers about their plans. Secretary Ward soon took over the editorship and used the *Quarterly* to communicate with chapters and reinforce the Society's national identity. No group lost its autonomy, and as each continued to stress its own goals, Sigma Xi still resembled a federation of local groups more than it did today's national Society. But many chapters began look-

Sigma Xi adapted to environmental change by creating a new organ, Sigma Xi Quarterly

ing outside themselves, and though disagreement continued on a variety of issues, illuminating discussions at conventions and in the *Quarterly* replaced heated debate.

The January 1913 convention established a Committee of Three to consider associate membership and a Committee of Five to propose amendments to the constitution. Within a year, the smaller group recommended "dual membership"—that is, associate and full membership—and passed its report on to the larger committee. Led by President James McKeen Cattell, an experimental psychologist at Columbia and owner and editor of *Science*, the Committee of Five urged other important changes beyond dual membership. It also strongly suggested replacing the Council—which then included all officers, all past presidents, and a representative from each chapter, thirty-eight people in all—with a seven-member Executive Committee, consisting of the president, the secretary, and five others serving five-year terms, with one retiring each year. This committee, designed to operate efficiently, would assume many responsibilities, including those of recommending new

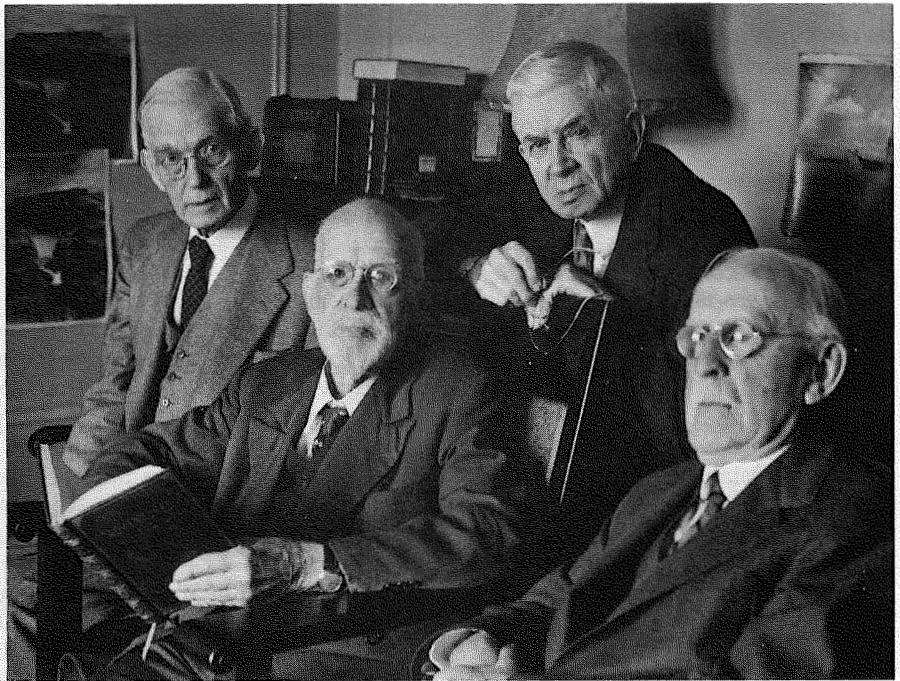
chapters and setting the time and place of the Society's annual meeting. The Committee of Five also proposed that easily amendable procedural bylaws be distilled from the constitution.

In December 1914, the convention delegates exhibited a new consensus, voting unanimously to establish bylaws and a powerful Executive Committee. However, fearing the cost of independent annual meetings—especially when each chapter collected its own dues and was assessed for national expenses by the secretary—the delegates retained a constitutional appendix under which Sigma Xi had been holding conventions with the AAAS. A thirteen-to-eight vote on associate membership again failed by one to get the necessary two-thirds majority to amend the constitution, but the ballot's closeness kept the question open, and the 1916 convention adopted dual membership by a vote of twenty-two to five. Most chapters apparently saw associate membership as an opportunity to honor students and encourage younger scientists. The Society thus devised a means of serving undergraduates that went beyond Tau Beta Pi's narrow focus and the fraternal plans of Sigma Xi's founders.

These constitutional revisions diverted attention from controversy over extension policy, and the only new chapters established between 1910 and 1919 were chartered in 1914, even before the new constitutional provisions were passed. One, at the University of Texas, was the Society's first southern chapter and thus represented a new form of extension to many northern members. The second, however, represented an even greater break with tradition. Though the constitution had authorized alumni chapters from the mid-1890s, no such group emerged before January 1914, when Sigma Xi alumni employed in Washington by the federal government gathered together. Led by Marcus Benjamin, a Columbia graduate and editor of the Smithsonian's publications, the group located 225 Society alumni in the Washington area and persuaded 172 of them to petition for a charter as the first chapter associated with a place rather than with a particular degree-granting institution. At a time when federal agencies carried out more research than many universities, the new District of Columbia chapter brought Sigma Xi positive attention.

Sigma Xi alumni were also setting up informal clubs; the first, a ten-member group in Duluth, Minnesota, announced its existence in the spring of 1913. Before 1920, several other such groups began meeting regularly, and these early clubs—quite different from today's formal clubs—fulfilled one of Sigma Xi's original goals by providing moral support for those doing scientific research.

The clubs had much in common with the chapters, which also devoted themselves primarily to "meetings to discuss scientific subjects." Many chapters, however, were moving away from having speakers who described their own research, sponsoring instead interdisciplinary meetings, exhibits, and demonstrations, designed to counteract the scientific overspecialization that had attracted much comment. They also designed public programs open to the larger community to help bridge the growing gap between scientists and nonscientists. The Illinois chapter took this activity one step farther. It



A large measure of continuity in the affairs of Sigma Xi has been provided by a succession of men serving extended terms in a single key office under the changing titles of secretary, executive secretary, and executive director. Henry Baldwin Ward (left), professor of zoology at the University of Nebraska and then at the University of Illinois, was secretary from 1904 to 1921. His major accomplishments were the compilation of the *Quarter Century Record and History*—the first major organization of Society records—and the establishment of *Sigma Xi Quarterly*—a publication originally designed to give members of individual chapters knowledge of the Society's activities and subsequently

charged its members to send news of their scientific work to local, state, and even national publications, and while such efforts were not always successful, the concern they demonstrated was real.

Chapters often worked with other organizations to promote scientific activity and attract public support for research. Soon after it was founded in 1916, the National Research Council asked Sigma Xi's "cooperation . . . in organizing . . . research facilities" in preparation for the country's expected entry into World War I, and the Society enthusiastically agreed. *Sigma Xi Quarterly* published editorials and articles announcing "New Work for Sigma Xi" and urging the Society's support for the war effort in general and the NRC in particular. War-related research, however, called active members away from their campuses, while national leaders found that their extensive involvement with the military distracted them from Sigma Xi's business. The expected growth had to wait for the war's end.

Expansion in a postwar world

For many Americans, the most striking aspect of World War I was the major bureaucratic structure erected to administer the 3-million-man army operating across the Atlantic. And as businesses and other organizations grew more complex after the war, they too adopted modern management techniques. Sigma Xi was no

transformed into *American Scientist*. Four other men who played prominent roles in Sigma Xi during the first half of the twentieth century were (from left to right) George B. Pegram, William F. Durand, George A. Baitzell, and Edward Ellery. All four served as president of the Society. Ellery, professor of chemistry and dean of Union College, was Henry Ward's successor as secretary, serving from 1922 to 1939. Baitzell, a Yale professor of biology, followed Ellery as executive secretary and presided as editor over the transformation of *Sigma Xi Quarterly* into *American Scientist*. Pegram served as treasurer for thirty-two years, and Durand presided over the semicentennial observances at Cornell.

exception, as its tremendous growth during the 1920s led to new administrative practices.

Growth came first: extension efforts recommenced as soon as the war ended, and surpassed the founders' dreams. In 1919 alone, three new charters were granted, and in the next nine years, twenty-three additional chapters were established. Like their predecessors, most were formed by Sigma Xi members, elected elsewhere, who found themselves teaching at institutions without chapters. Many of these institutions, such as the Universities of Oregon and Oklahoma and Johns Hopkins and New York University, resembled those that had supported chapters since the 1890s. But others represented departures from past practices and thus demonstrated the Society's continued adaptation to its changing environment. For example, the Mayo Foundation chapter—initially chartered in 1919 as an alumni chapter, but soon reorganized—enabled the Society to recognize researchers working in a nonuniversity setting. Other new chapters at North Carolina, Kentucky, and Virginia showed that bias against the South had dissipated, and the McGill chapter, chartered in 1921, was the first recognized outside the United States.

In many ways, however, the establishment in 1922 of a chapter at Swarthmore College broke most with the past. Existing chapters represented universities or engineering schools, and Swarthmore was clearly an undergraduate college. Its faculty included several distin-

guished researchers, however, and the Society debated its response to their inquiries. The Executive Committee wavered on the college's eligibility for several years, and, when it finally in 1921 recommended granting a charter, the convention tabled the proposal. The committee repeated its recommendation the following year, and finally, after heated debate, the petition was granted.

Informal clubs also sprang up in profusion. No definite count exists, as some met just once or twice while others continued for years. In 1926, the Society published two pages of "Information for the Guidance of Sigma Xi Clubs," with detailed recommendations for establishing and operating them. Clubs thus obtained formal standing and could take part in convention activities, though without a vote. They still lacked authority to elect even associate members, but groups wanting to establish a club did not have to submit formal petitions to the Society. Many clubs served as precursors of chapters, and as early as 1921 the Executive Committee noted that "in most cases the organization and maintenance of a Sigma Xi Club would serve to demonstrate" that a group should petition for chapter status. By 1929, groups originally founded as clubs at Kentucky, Idaho, NYU, and Michigan State had all become chapters.

Clubs could not serve all Sigma Xi alumni, many of whom had little contact with others doing scientific research. These isolated individuals had found in the Society companionship and moral support, and they began seeking a more active role in Sigma Xi. In 1923, after various unsuccessful attempts to respond, a constitutional change provided for an Alumni Committee with

By 1927, Sigma Xi had firmly committed itself to a program (which continues today) of awarding smaller grants-in-aid of research to younger scientists

representation on the Executive Committee. Among other activities, the committee regularly sponsored reunions in large cities and at major scientific meetings.

By the end of 1929, Sigma Xi consisted of fifty-one chapters, about twenty-two clubs, an active Alumni Committee, and about 9,000 active members. The Executive Committee, which once could handle its business in an hour or two before the annual convention, had long since found that busy semiannual meetings still left its members with a heavy flow of regular correspondence. Henry Ward in particular felt the burden greatly. He had served as secretary since 1904. He had tried to resign before, but a succession of presidents had come to value his experience. Wishing to devote less time to Society matters and more to his own scientific work, he retired as secretary in December 1921.

In choosing Edward Ellery of Union College as Ward's successor, the Executive Committee selected a very different kind of man. Ward was autocratic and impatient, while Ellery rarely ruffled feathers. Ward had

always been an active scientist, earning an international reputation even while serving Sigma Xi. Despite his Heidelberg Ph.D., Ellery was more of an administrator, becoming in 1919 Union's dean of faculty. He enjoyed traveling, and his temperament suited him well to the Sigma Xi of the 1920s.

On taking office, Ellery began centralizing many of the Society's activities while taking care to respect chapter autonomy. He worked to ease the chores of chapter secretaries, and introduced *Quarterly* notes for chapter officers. A more harmonious and efficient Society resulted, as chapter officers, who had sometimes smarted under Henry Ward's criticisms, responded more readily to honey than to vinegar.

Ellery's frequent travel in the 1920s gave him a better feeling for the Society's—and its chapters'—health than anyone had had since the days of Henry Shaler Williams. He also distilled up-to-date membership records from Ward's chaotic files and located many missing members. Ellery standardized the procedures used by visitors examining the qualifications of prospective chapters and thus rationalized the process of extension. He responded immediately to signs of a chapter's weakening and could revive groups that verged on total collapse.

Such expanded activity contributed much, but it did not come cheap. During the 1920s, the Society instituted an initiation fee (paid to the national organization) and raised the annual assessment (paid by each chapter for each affiliated member) to \$1.00 from the \$0.75 that had long prevailed. Ellery hired an assistant in 1925, and the following year, the Society began paying Ellery himself an annual salary of \$1,800. Through the 1920s, then, Sigma Xi members discovered that an active Society required financial support, and in that booming decade many were glad to help.

One program—the ancestor of Grants-in-Aid of Research—attracted much support and by the end of the decade had become a significant means through which Sigma Xi promoted scientific research. In 1917, with the fervor accompanying the country's entry into the war, President Julius Stieglitz had called for the endowment of three Sigma Xi fellowships—one each in the physical sciences, the biological sciences, and engineering and applied science—that would "enhance the working power" of the recent Ph.D.s to whom they would be awarded. The Executive Committee endorsed Stieglitz's proposal, but members' wartime efforts and the conflict's abrupt end both distracted attention from it.

In 1920, Society officers saw that a fellowship program could help attract inactive alumni and define more precisely Sigma Xi's goals and purposes, and they began soliciting donations. They ran immediately into a problem, however, as the National Research Council, with massive support from the Rockefeller and Carnegie foundations, instituted its own program of postdoctoral fellowships in physics and chemistry. With its initiative thus forestalled, Sigma Xi limited competition for its fellowships to fields not supported by the NRC. In October 1921, a committee chose Alexander Weinstein, a young geneticist who had worked with Thomas H. Morgan at Columbia, as the first Sigma Xi fellow.

Many Society officers resented the NRC's theft of

their thunder, especially when the Rockefeller-funded General Education Board instituted NRC postdoctoral fellowships in the medical sciences the following year. This action left the fellowship program in disarray, and for several years it floundered. By 1927, however, Sigma Xi had firmly committed itself to a program (which continues today) of awarding smaller grants-in-aid of research to younger scientists.

Sponsoring these grants allowed Sigma Xi to play an important role in the scientific research community, but many members thought that the grants were not enough, since they could not support any large-scale scientific work in the emerging world of what soon became known as "big science." These dissatisfied members looked to the National Research Council and privately funded research organizations and saw that Sigma Xi's limited finances restricted its involvement in the day's major science policy issues.

Believing that the Society was losing its status and influence, several officers, led by Edward Ellery and President Clarence E. McClung, did what they could to link Sigma Xi to other scientific organizations. In 1919, Sigma Xi officially affiliated with the AAAS, and in 1922, the Society instituted an annual Sigma Xi lecture that remained an important part of each AAAS meeting through 1970. In 1921, McClung joined the NRC Executive Board, and in 1923, the Society elected to the Executive Committee Vernon L. Kellogg, a long-time Sigma Xi member and the NRC's permanent secretary. Kellogg regularly joined McClung in arguing for an expanded national focus. In 1927, he was elected Society president, but he had by this time begun withdrawing from Sigma Xi affairs, and so he refused the honor. Thus repulsed, the Society abandoned for the time being all attempts to strengthen its ties with national "big science" institutions.

Kellogg's departure further convinced those members who believed that the Society had found its appropriate niche in the national scientific community by sponsoring grants-in-aid of research, chapters' grants, and fellowships (which many groups established during the 1920s) and offering moral support. They argued that it was more important for Sigma Xi to help scientists at the Universities of North Dakota and Arizona to overcome the disabling influence of isolation than it was for the Society to be represented on an NRC committee. But other members disagreed, and this debate continued for many years.

Another continuing controversy of the 1920s revolved around the question of eligibility for election. Through all revisions, the constitution specified only "noteworthy achievement as an original investigator in some branch of pure or applied science" or, for students, "an aptitude for scientific research." Many members, inspired by Edward Ellery's attempts to rationalize procedures, believed that some uniformity should be imposed, and some even charged that the election practices of many chapters violated all that the Society stood for. Others cited chapter autonomy and the need for special local policies, and for years the issue attracted much discussion and, at times, angry debate.

This furor died down only as the Society began debating the meaning of "science." Different chapters

again followed different practices, but the issue came to a head at the 1927 convention with the news that a newly elected member was "registered in the Department of Public Speaking." In the shocked discussion that followed, Northwestern University physicist Henry Crew categorized all knowledge, and, at the convention's request, he expanded his analysis in a *Quarterly* article. The article's list of sciences—mathematics, physics, chemistry, astronomy, "science of the Earth," biology, anthropology, "medicine in its various branches," and "engineering in its different branches"—surprised nobody. In May 1928, the Executive Committee accepted Crew's list—after substituting "biology in its various

The issue of eligibility came to a head at the 1927 convention with the news that a newly elected member was "registered in the Department of Public Speaking"

branches, including psychology" for "biology"—as indicating the Society's purview.

With this action, the Committee believed that it had settled the issue, but at least one chapter felt restricted by the new policy. The Cornell chapter had long since abandoned any list of fields, using instead a three-part definition of research that stressed the approach taken rather than the problem being studied. The debate continued for several years, and in March 1930, under the leadership of a new president—George W. Stewart, a University of Iowa physicist—the Executive Committee reached a compromise. It reaffirmed that Crew's list, as modified, represented the fields of research on which Sigma Xi focused. But it stressed that workers in "others closely allied" could also be elected to the Society, explicitly recognized "the distinction between a field of research and a department of instruction," and instituted a procedure through which doubts about eligibility could be referred to the Executive Committee.

Sigma Xi and the Depression

Though several chapters lost money when the banks failed, the Depression of the 1930s affected Sigma Xi only slightly, thanks in large part to the generosity of Professor Ernest J. Berg. Internal forces did more to guide the Society's course during the decade, and these typically reflected earlier concerns.

In particular, extension slowed only negligibly. Through the decade, twenty-six chapters were chartered, including important ones at Harvard, Princeton, and MIT. Society members at leading women's colleges like Smith, Bryn Mawr, and Wellesley also established chapters, though their efforts met some initial opposition. Other new chapters, including those at Buffalo, Duke, and George Washington, grew out of clubs, and clubs themselves were founded at a faster rate than chapters.

Some older chapters, however—particularly at larger universities, where members had come to doubt

Sigma Xi's relevance to their "big science" interests—had become inactive, and the Executive Committee even considered revoking at least two charters. Many chapters found that their primary activity—sponsoring scientific lectures—had been usurped by other groups. Realizing that Sigma Xi had to "serve some other function," they looked to the national Society for suggestions.

Fortunately, Edward Ellery responded readily. Although he knew that Sigma Xi's survival was not threatened, he also believed that simply honoring research achievement did not fully serve the Society's constituency. He therefore stressed "promotion of research" but also argued that Sigma Xi should avoid direct competition with the NRC. In a *Quarterly* article, Ellery described programs that chapters had found successful and that demonstrated Sigma Xi's concern for younger scientists: awarding research prizes, offering fellowships, raising money to support the Society's

Through 1945, the roster of National Lecturers included four past and five future Nobel Prize winners

grants, and the like. Through the decade, many chapters adopted these activities, and, as the Depression worsened, several instituted loan funds for needy students. Again, Sigma Xi attacked those problems that it could deal with most successfully.

George Stewart tried to establish several broadly conceived programs that would have gone even farther. In 1930, for example, he introduced a resolution calling for federal grants to the states with the explicit aim of stimulating research, but delegates and the Executive Committee debated this proposal to death. One year later, he presented a "Classification of the Objectives of the Society" that barely mentioned Sigma Xi's function as an honor society, emphasizing instead the promotion of scientific research through increased financial support, improved facilities, and efficient organization, and proposing that the Society investigate ways to enhance "the research function of teachers." The committee discussed Stewart's ideas but finally voted simply to make "the memorandum . . . a part of the permanent record of the meeting."

In 1930, Stewart proposed a Committee on the Conservation of Research Talent, to keep younger scientists in the field and the laboratory and off the breadlines, but delegates approved only Sigma Xi Certificates of Award in Commendation for Research, presented each year to students at institutions without Society chapters. First awarded in 1932, the certificates never attracted much attention. Stewart tried to strengthen the program by having award winners elected to the Society, but his colleagues rejected this proposal. In 1937, when only five students from three schools submitted entries, the Society discontinued the program. The failure convinced Society members that Sigma Xi had to become better known within the scientific community and to the public

at large, and many activities through the mid- and late 1930s stressed this aim.

Sigma Xi began planning for its semicentennial as early as 1930. Frank Van Vleck and two other founders attended the anniversary meeting held in June 1936 at Cornell, and with almost 700 members present the Society dedicated a memorial to its foundation. A formal program featured short talks by officers and major addresses by national figures such as the presidents of MIT (Karl Compton), the Rockefeller Foundation (Max Mason), and the National Academy of Sciences (University of Chicago biologist Frank R. Lillie), and by Willis R. Whitney, General Electric's vice president of research. The *New York Times* gave the event front-page coverage and editorialized on its importance.

Adaptations of past practice, however, were the celebration's features of lasting significance. A major fund-raising effort helped expand the Grants-in-Aid of Research program, and the Society also awarded two \$1,000 prizes—one each in the physical sciences and the biological sciences—to researchers under the age of 40. The biological prize went to Richard E. Shope, a Rockefeller Institute microbiologist, and I. I. Rabi of Columbia University won the physical prize, for research in nuclear magnetic phenomena.

Throughout the celebration, the Cornell chapter sponsored exhibitions related to the Society's early years and "demonstrations of research in progress among younger Cornell scientists." Barbara McClintock was among those exhibiting their work; her demonstration of chromosome dynamics attracted national attention. Both Rabi and McClintock had earlier been elected to Sigma Xi—he in 1926 at Columbia and she in 1924 at Cornell—and both later won Nobel Prizes.

Sigma Xi's National Lectureships, which began in the late 1930s, also supported the Society's outreach efforts and increased its visibility. Since 1907, midwestern chapters had jointly invited prominent scientists to visit their campuses, and Edward Ellery always kept files of members ready to address chapters. But chapters needed more, and in 1935 a committee proposed establishing a bureau that would select speakers and sponsor (and partially support) their lecture tours. The first group of lecturers chosen (for 1937) included a past and a future Nobel Prize winner (Harold C. Urey and Ernest O. Lawrence)—each elected to Sigma Xi in 1923—and three other eminent scientists. For each, Ellery set a two-week itinerary that took into account their requirements and chapter requests. Ernest Lawrence, for example, visited eight institutions, from Virginia Polytechnic Institute to Oregon State College. Equally prominent lecturers were selected during the following years—through 1945, the roster included four past and five future Nobel Prize winners—and the program brought Sigma Xi much favorable notice.

In 1939, the 1937 and 1938 National Lectures appeared in print in a volume entitled *Science in Progress*, edited by President George A. Baitsell, a Yale biologist. Reviews in the *Saturday Review* and the *Christian Century* noted how it conveyed "the surge of discovery" to nonscientific readers, a purpose that *Science in Progress* continued to serve in the fifteen volumes that followed the first up to 1968.

American Scientist and the wider world of research

With the semicentennial's success and improving economic conditions in the late 1930s, Sigma Xi seemed ready for further growth. In 1937 the Executive Committee formed a Committee on Policy, whose major report of April 1938 focused on the secretary's office and *Sigma Xi Quarterly*, suggesting major changes in both. Edward Ellery was then 70 years old, and although it praised his accomplishments, the committee urged that his successor devote more attention to long-range planning. The *Quarterly* meanwhile had grown beyond its newsletter function and sometimes published broadly interesting articles. But it had never had an official editor or editorial board, and Ellery (like Henry Ward before him) simply assembled material submitted by members and chapters. Some members urged expansion of the *Quarterly* into a journal "within the field of science more or less equivalent to the *American Scholar* [published by the United Chapters of Phi Beta Kappa] in the field of arts and literature." But others disagreed, and the Executive Committee formed yet another committee to consider the *Quarterly's* future.

In April 1939, the special committee urged a major redefinition of the *Quarterly*, recommending an increase from 200 or so pages to "some 500 to 600 pages per year." Further, while agreeing that "the *Quarterly* should continue to report" Sigma Xi news, the committee recommended an emphasis on articles presenting "recent advances in the various fields of science." To oversee the revised journal, it recommended an editorial board and an independent (and salaried) editor in chief, authorized to commission (and pay for) "special summaries of research." All realized that the costs involved would require gradual implementation of the proposed changes.

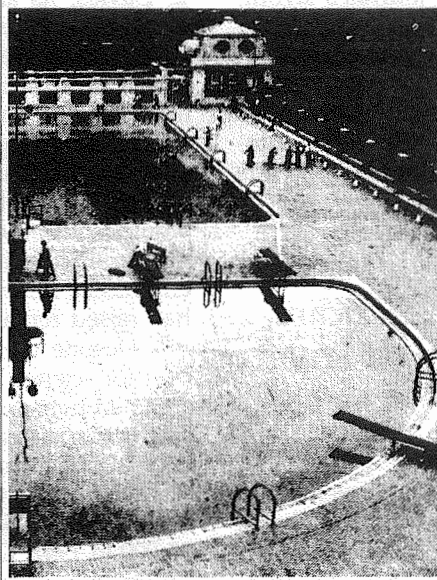
After eighteen years as secretary, Edward Ellery was to retire late in 1939, and the Committee on Nominations selecting his successor included the chairman of the Committee on the *Quarterly*. Both groups kept in regular touch with President George Baitzell, who had plans for his own future as well as Sigma Xi's. Better known as an editor of textbooks and volumes like *Science in Progress* than as a researcher, Baitzell wrote well and believed that he could edit the *Quarterly* effectively. He had long served Sigma Xi, through his chapter, the Executive Committee, and the Semicentennial Committee, and his offer to assume both the secretaryship and editorship of the *Quarterly* was enthusiastically received. In December, the Committee on the *Quarterly* recom-

mended that, to reduce costs, the secretary also serve as editor in chief. The convention held that month adopted this recommendation, and also elected Baitzell secretary. For the next thirteen years, Sigma Xi's course was bound to George A. Baitzell.

In assuming his new duties, Baitzell moved the Society's offices to Yale and focused his attention on the journal. Major changes soon followed. Baitzell never formed an editorial board or commissioned the "special summaries of research," but from 1941 he devoted more space than Ellery had to articles of general scientific

The New York Times.

SUNDAY, JUNE 21, 1936.



SIGMA XI PRIZES MARK 50TH YEAR

Research Awards of \$1,000
Each Are Made at Anniversary
Session at Cornell.

DISEASE CAUSE WINS ONE

This Goes to Dr. Shope of
Rockefeller Institute—Other
to Prof. I. I. Rabi.

By WILLIAM L. LAURENCE

Special to The New York Times.
ITHACA, June 20.—Sigma Xi scientific honor society, numbering among its members the leading research workers in the country, today honored two of them with the award of semi-centennial prizes of \$1,000 each for research, one in biology and the other in physics.

New York 'V Among t

Business Here Makes
Packers, Fisherm
and Othe

There is no city in States that worries i rain, sunshine or chill York. Equal to this e the elements is that c who tells city dwellers weather will be.

Surrounded by tick ments in his perch atop hall Building, Dr. Jam ball told yesterday how force of the Weather sponds to the ever-growi of the public.

"There is no city in that is so vitally in weather as New York Kimball. "Certainly no country uses its weathe better advantage than "We are making for definite," explained D "They are gradually be larized as to detail an the probable temperatu row. We now set out

The Society's semicentennial celebration, which was held at Cornell on 19 and 20 June 1936, attracted the attention of the national press through the award of research prizes in the physical sciences and the biological sciences. Among the young members participating in the celebration were I. I. Rabi and Barbara McClintock. Both later received Nobel Prizes. (Copyright © 1936 by the New York Times Company. Reprinted by permission.)

interest. In 1943, G. Evelyn Hutchinson, a fellow Yale biologist, began contributing personal musings on different scientific topics to a regular feature called "Marginalia," and with his fine prose style and eye for interesting subjects he attracted many readers. "The Scientist's Book Shelf," a book review section that most Society members welcomed, also first appeared that year. Kirtley F. Mather, a Harvard geologist, friend of Baitzell's, and director of the Scientific Book Club, prepared most notices. The Society paid both Mather and Hutchinson, and Mather further benefited by publicizing the selections of his book club. Both features added much to the journal, which began to attract nonmember subscribers. In 1944, the Society began paying Baitzell \$1,500 as editor, in addition to the \$3,500 he received as executive secretary.

Emphasizing science in general, the *Quarterly* in 1942 became *American Scientist*, a name first suggested in

the late 1930s. The next five issues kept "The Sigma Xi Quarterly" as their subtitle, but even this had vanished by July 1943. The new title and revamped journal pleased many members, but not all, especially those who feared domination of the Society by individuals from the Ivy League. *American Scientist* continued to publish Society material, but only in a smaller type face and a reduced double-column format. From 1943, even much of this material vanished from the journal, appearing only in separate annual reports. Baitzell relegated those items still published in *American Scientist* to the advertising section (itself a major innovation, which strengthened Sigma Xi's financial status and paid Baitzell's, Hutchinson's, and Mather's stipends) and assigned them a separate pagination. The pages resembled an obstacle course, as readers had to jump around ads to follow the reports. In binding the journal, many libraries discarded all advertising matter, and Sigma Xi material was often lost. After 1945, Baitzell discontinued the separate pagination and improved the journal's layout. But Society news still appeared in Baitzell's own "Editorial Miscellany" column, scattered among other items of general scientific interest.

In 1945, the almost 80-year-old Edward Ellery introduced a "Personalia" feature, which reviewed the comings and goings of Sigma Xi members and the honors

Emphasizing science in general, the Quarterly in 1942 became American Scientist, a name first suggested in the late 1930s

and awards they received. This was soon supplemented by artist S. J. Woolf's portraits in word and pencil sketch of leading members, like Harvard astronomer Harlow Shapley and entomologist William Procter. In 1946, Sigma Xi received almost \$18,000 from *American Scientist* advertising and nonmember subscriptions, covering more than half the cost of the journal, which the Society still supplied without additional charge to members whose chapters had paid their national assessments. Most members seemed pleased with the journal, and officers were especially full of praise. In December 1943, "the Secretary was instructed, by a vote of the [Executive] Committee, to insert the following line at the top of the title page: 'George A. Baitzell, Editor.'"

Baitzell also devoted some attention to the Society's organization. In 1942, he oversaw a major constitutional revision and ended many years of fruitless discussion by incorporating Sigma Xi as a nonprofit institution in Connecticut, thus enabling it to be exempt from taxes and further tying it to Yale. Through the 1940s, a new Committee on Examination of Credentials for Election to Membership (CECEM) worked to stimulate chapters to induct eminent scientists not already members, and the Society grew. To be sure, CECEM met with less success than Baitzell had hoped for, but even during wartime clubs petitioned for charters and chapters were installed. Club growth was even more rapid, especially after a 1938

amendment formally recognized clubs, charging assessments at half the rate of chapters. Clubs still could not elect even associate members, and their precise place in the Society's scheme of things remained vague. In 1941, the Executive Committee asked Baitzell to address the matter, but he was too busy with *American Scientist* to do so. The growth of clubs soon made this question imperative, and in 1945 a committee led by Edward Ellery revised many operational procedures but left much about the clubs' formal status unsettled.

As this episode shows, in the 1940s Baitzell was often too involved with the journal to spend much time running the Society. Similarly, wartime duties often distracted Treasurer George B. Pegram of Columbia (who had served since 1917) from his Sigma Xi chores. Both therefore slighted many details, and though they always explained away irregularities by citing the dearth of qualified office help, even after the war things did not improve. The Executive Committee twice had Clarence E. Davies, its alumni member for many years, use his administrative experience as long-term secretary of the American Society of Mechanical Engineers to study Sigma Xi's operations, and twice he reported basic inefficiencies and other major problems. The Society expected great postwar growth, and Davies repeatedly stressed that its procedures could not deal with larger numbers. Baitzell admitted the problems, but claimed he would solve them once the expected growth allowed him to hire additional personnel. He thus continued to emphasize *American Scientist*, and the issues that Davies had raised remained unresolved.

Despite these operational difficulties, wartime support for science brought Sigma Xi to new heights. Firms that had perceived research laboratories as luxuries now saw them as golden opportunities to attract federal dollars. Instrument makers, chemical suppliers, and scientific publishers all advertised their products widely, and *American Scientist's* circulation rose to more than 35,000 in 1947. Other aspects of Sigma Xi also flourished under the animated leadership of President Harlow Shapley, director of the Harvard Observatory since 1921. Shapley brought the Society the scientific stature that George Baitzell lacked, and his wide experience increased the Society's contacts with related organizations. He had a strong personality that occasionally irritated people, but his energy and breadth impressed most members, and many loudly cheered his 1943 accession to the presidency.

Caring little for Sigma Xi's honorary function, Shapley emphasized its role in promoting scientific research. He shunned its Greek-letter name, which to him suggested the worst aspects of social fraternities, arguing instead for a "descriptive subtitle." Accordingly, the 1945 Annual Report was headed "The Society of the Sigma Xi—Scientific Research Society of America." Throughout his term, Shapley appeared in public and before Congress as an officer of the Scientific Research Society of America. He claimed many advantages for the name, noting that at least it saved much explanation.

More substantively, Shapley believed strongly—like his predecessors Clarence McClung and George Stewart—that Sigma Xi should play a major role in the American scientific community, and, as the "big sci-



The famous Harvard astronomer Harlow Shapley was an important figure in the Society, serving two terms as president in the mid-1940s and presiding over the Committee on Grants-in-Aid for many years. Shapley was a tireless advocate of a role for Sigma Xi in "big science." This pencil sketch, which appeared in *American Scientist* in 1946, was one of a series executed by S. J. Woolf.

ence" of the 1920s and 1930s grew even bigger during the war, he wanted Sigma Xi to help shape American science policy. Unlike most previous Society leaders, he thought little of Sigma Xi's tradition of chapter autonomy. He tried hard to reach his goal, and little restrained him, but in the long run he had as little success as Stewart and McClung. In 1942, for example, as a member of the Executive Committee, Shapley began urging Sigma Xi to lobby for bills proposing what eventually became the National Science Foundation. Stewart's analogous recommendation of the early 1930s had been ignored, but the Executive Committee paid some attention to Shapley's. It always moved cautiously, however, reflecting its members' qualms about the bills, their desire to avoid taking positions on political issues, and their worries about Shapley's disregard for chapter autonomy. Consequently, when Shapley left the presidency in 1947, Society interest in this and related issues seemed to die.

The Sigma Xi Committee on Research—established in 1945 at Shapley's urging—did attract many members'



Hugh S. Taylor, longtime dean of the graduate school at Princeton, served as president in the early 1950s and replaced George Baitzell as editor of *American Scientist* in 1955, remaining in that position for fifteen years. This pencil sketch by S. J. Woolf also appeared in *American Scientist* in 1946.

interest. Charged "to formulate an adequate national research program for the Society and to recommend means for financing it," it included several distinguished scientists, such as Frank B. Jewett, president of the National Academy of Sciences, and W. D. Coolidge of the General Electric Research Laboratories. In addition, Baitzell and Shapley asked William Procter to join the committee. An heir of one of the founders of the Procter and Gamble Company, Procter had retired from a profitable investment business in 1920 to study entomology at Columbia. Soon afterward he built a field laboratory on Mt. Desert Island, Maine, and began publishing in his specialty.

First meeting in September 1945, the committee members initially could only agree that Sigma Xi should support research. Like their predecessors in the 1920s and even earlier, they disagreed as to how they should dispense such support. And though they realized that any new or larger programs would cost much, they could not move beyond a vague reference to "donations by corporations." Hoping to stimulate activity, William

Procter then offered to pay \$5,000 as the salary of a committee "field representative," who would "visit chapters and clubs, survey the opportunities, and formulate a proposed course of action." The committee quickly accepted the offer, and the Executive Committee agreed to cover the representative's expenses.

Shapley's other scientific interests distracted him, and he thus left the choice and direction of the field representative to George Baitsell. Baitsell chose a young invertebrate physiologist, Talbot H. Waterman, a Harvard graduate who was scheduled to join him at Yale the following fall. During the war Waterman had worked on radar development, and with scientific experience in many fields, he seemed a perfect choice. But Baitsell's priorities were not Shapley's, and the executive secretary warned Waterman not to stress research-related questions but rather to concentrate on organizational matters. As Waterman later recalled, Baitsell told him to "pick up Sigma Xi's unraveled threads, pull things together, and see what ideas were around."

Through 1946, Waterman traveled widely and corresponded at length with the few Sigma Xi groups he did not visit, and his detailed report dealing with almost all aspects of the Society appeared as part of Sigma Xi's 1947 annual report. Fully half of Waterman's statement reviewed chapter and club activities, emphasizing such topics as election policies, public lectures, and prizes.

With the Committee on Research died the hopes of members who shared Shapley's aspirations for a Society with direct influence on national science policy

Another large section examined the "effectiveness of the national organization," concentrating on four programs: *American Scientist*, National Lectureships, the *Science in Progress* series, and Grants-in-Aid of Research. In conclusion, Waterman mentioned that some thought Sigma Xi should play a more active role in national scientific affairs and recommended simply that the Committee on Research continue meeting.

Response to Waterman's report was mixed. Involved as he was with *American Scientist*, George Baitsell focused on Waterman's recommendation for the journal—"keep up the good work"—and let the other ideas lie. Harlow Shapley found the report disappointing, as Waterman—responding to Baitsell—had slighted research. Shapley thus began planning a second survey by a new field representative who would emphasize research. Distrusting Baitsell, Shapley used his own wide contacts to secure a grant of \$5,000 from the American Philosophical Society.

Both Sigma Xi and Shapley, however, were becoming increasingly involved in other matters. Shapley's international interests led witch hunters like the House Committee on Un-American Activities and Senator Joseph McCarthy to bring unsubstantiated charges against him. The AAAS elected Shapley president in December 1946, in part to rebuke the House committee's reckless-

ness and in part to take advantage of Shapley's leadership. Going out of his way to publicize his continuing international concerns, Shapley threw himself into AAAS affairs. His term as Sigma Xi president ended in July 1947, and though he chaired the Committee on Grants-in-Aid of Research until 1969, he withdrew from most Sigma Xi activities. His successor—Carl D. Anderson, 1936 Nobel Prize winner in physics—deferred to George Baitsell on most Society matters, and the Committee on Research was allowed to expire. With it died—at least temporarily—the hopes of members who shared Shapley's aspirations for a Society with direct influence on national science policy.

The founding of RESA

As industrial laboratories bloomed, many Sigma Xi members began doing research in settings unforeseen by the founders. Some members sought to participate in the Society's affairs by affiliating with the nearest chapter, while others organized clubs identified with a city rather than with an academic institution. By 1946, scientists at the Standard Oil Company of New Jersey Research Laboratories, Abbott Laboratories, the Corning Glass Works, and the Shell Development Center had organized Sigma Xi clubs at their workplaces. The industrial clubs provided a forum that many university scientists took for granted, nurturing their members' interdisciplinary interests, giving them opportunities to learn from their co-workers, and stimulating the companionship that the founders had envisioned.

Some of the Society's leaders—like Harlow Shapley and George Baitsell—saw Sigma Xi's expansion in this direction as following the precedent set by the establishment of the Mayo chapter in 1920. Since everyone expected nonacademic laboratories to mushroom in postwar America, they argued that adding industrial clubs and chapters would strengthen Sigma Xi and give it further access to the councils of "big science." In addition, why should duly elected Sigma Xi members be denied the Society's benefits just because they worked outside academia? Nonetheless, many academic researchers deprecated industrial science, suggesting that practically oriented research and proprietary and classified science perverted the true scientific spirit. As one chapter phrased it, Sigma Xi "cannot uphold free and independent research in nonacademic institutions."

The controversy led to the creation of a Sigma Xi-related organization for industrial and government researchers. George Baitsell first proposed such an organization in 1947, stressing its advantages "in conserving the present values of Sigma Xi in the chapters and clubs located in educational institutions, and additional advantages to be gained in research institutions." He discussed his plans with Sigma Xi officers, and, with a \$5,000 donation from William Procter, the Scientific Research Society of America—known as RESA—was incorporated that November. The next month, Baitsell informed the chapters and clubs that the Executive Committee had established the new society "as a separate organization, permanently owned and controlled by Sigma Xi."

Baitsell and other Sigma Xi members devoted much time to organizing RESA. They drafted a constitution

modeled closely after Sigma Xi's, with branches, a chairman, a director, and a Governing Board performing the same functions as Sigma Xi's chapters, president, executive secretary, and Executive Committee. Sigma Xi effectively controlled RESA's Governing Board, as the older society's president, executive secretary, and treasurer all served as ex officio members and at least five of nine elected members had also to be Sigma Xi members. By May 1948, Sigma Xi's Executive Committee approved the constitution, William Procter gave an extra \$5,000, and Sigma Xi transferred to the fledgling group its \$5,000 American Philosophical Society grant.

That November, the RESA incorporators elected the society's first officers—as chairman, George A. Stetson of the American Society of Mechanical Engineers; as director, Donald B. Prentice, recently retired president of Rose Polytechnic Institute; and as treasurer, George Baitzell—and selected a Board of Governors that included William Procter. When the 1948 Sigma Xi convention ended, most delegates stayed on for RESA's first general meeting. The following June, when George Pegram retired after thirty-two years as Sigma Xi treasurer, Prentice succeeded him, thus further strengthening the societies' interlocking directorates. RESA distributed *American Scientist* at cost to its members and joined Sigma Xi in sponsoring the National Lectureships Program and awarding grants-in-aid of research.

This symbiosis did not satisfy Baitzell, however, who campaigned actively to unify the societies. Throughout these efforts, his optimism about the future, his desire for control, and his ambition for the societies, the journal, and himself all emerged clearly. Baitzell's optimism was well founded, as both societies thrived in the postwar boom. In 1948, Sigma Xi chartered its hundredth chapter, and by 1950, it boasted of 108 chapters and 57 clubs, assets of almost \$70,000, a budget of almost \$100,000, an operating surplus of almost \$15,000, and about 42,000 active members. RESA was smaller of course, with twelve branches, two clubs, a budget of about \$12,000, and almost 1,750 members.

RESA had high hopes, and it also had William Procter's support. His service as a director of Procter and Gamble had convinced him of the importance of industrial research, and in 1950 he endowed an annual William Procter Prize for Scientific Achievement. Karl T. Compton, then MIT president and RESA chairman, became its first recipient. Procter died in 1951, and his \$100,000 bequest to RESA—he left a much smaller sum to Sigma Xi—gave RESA the financial security that Sigma Xi had always sought. RESA's health reinforced George Baitzell's arguments for unity, and early the next year Sigma Xi's president, Hugh Stott Taylor, acted on them.

A founding member of the Princeton chapter in 1932 and dean of Princeton's graduate school since 1945, Hugh Taylor became president in July 1951, and soon, under George Baitzell's influence, he planned a RESA-Sigma Xi merger. He proposed the creation of an umbrella Scientific Research Society of America, with "a single set of national officers and a unified Board of Control," which would provide national leadership, while two separate sections—a Sigma Xi division and a RESA division—would operate as federations of chapters and clubs. In March 1952, Baitzell convinced both socie-

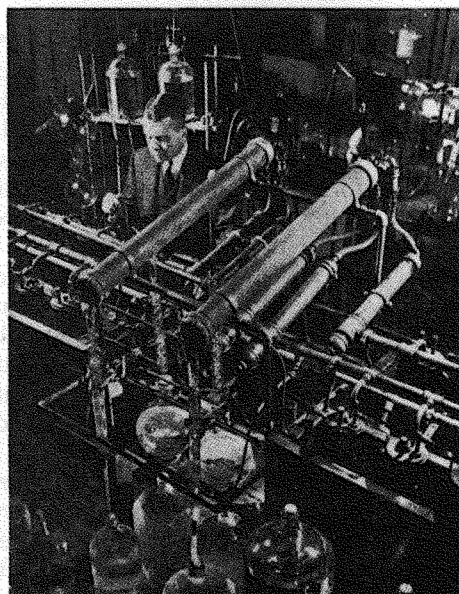
ties' officers to authorize Taylor to present his proposal to the chapters, clubs, and branches and ask for their responses.

It was quickly apparent that most Sigma Xi groups were vehemently opposed to unification. Even those groups that favored the plan urged that the new society retain Sigma Xi's name and constitution. Several chapters circulated opposing resolutions whose harsh tone was unusual for academic discourse. One chapter plead-

SIGMA XI'S FIRST PUBLISHED VOLUME

SCIENCE IN PROGRESS

EDITED BY GEORGE A. BAITSELL



YALE UNIVERSITY PRESS

The National Lectureships Program has been one of the Society's most successful activities. From 1939 to 1968, many of the lectures were assembled in volumes entitled *Science in Progress*. This advertisement for the first volume appeared in *Sigma Xi Quarterly* in 1939.

ed that "Sigma Xi must not sell its birthright for a mess of pottage," a point that others made less metaphorically. Another wrote that the "proposed union sounds like admitting the US to Alaska," while more than one asked, "Would industrial elections lower the honor value of collegiate elections?"

Most objected so vehemently because they felt that the national officers had tried to dictate to chapters and clubs. Frank Van Vleck and the other founders had envisioned a federation of autonomous chapters, and most of the chapters were still proudly independent. Hugh Taylor, who had been led by George Baitzell to expect a positive response to his proposal, was deeply hurt, and even considered resigning, "since the opposi-

tion believes I am selling Sigma Xi down the river." He stayed in office, however, and chaired the 1952 convention that discussed the poll's results. Both Taylor and Baitzell pleaded for reconsideration, but the delegates remained firm, and Sigma Xi and RESA remained separate bodies for twenty-one years.

It was now apparent that George Baitzell had lost touch with the Society, and his isolation from the chapters and clubs, and from the Society's daily opera-

One chapter pleaded that "Sigma Xi must not sell its birthright for a mess of pottage"; another wrote that the "proposed union sounds like admitting the US to Alaska"

tion, caused Sigma Xi many problems. Despite his wartime promises and the Society's great growth in the late 1940s, Baitzell devoted even less time to his duties as executive secretary. Meanwhile, many grew dissatisfied with Baitzell's editorship of *American Scientist*. His "Editorial Miscellany" often skewed priorities: for example, the January 1948 issue paid more attention to the centennial of Yale's Sheffield Scientific School than it did to the founding of RESA. Indeed, one major complaint about Hugh Taylor's proposal was that Baitzell's *American Scientist* had—after two or three useful articles—devoted so little (and so poorly laid out) space to RESA that most Sigma Xi members knew almost nothing about the group.

In his capacity as Sigma Xi's new treasurer and RESA's director, Donald Prentice undertook to review the societies' books more carefully than had ever been done before. He found that George Pegram had left a financial mess and George Baitzell had compounded it. Bills remained unpaid or were paid twice. Many members whose chapters had paid their national assessments—there were still no national dues at the time—never received *American Scientist*, and inactive members kept receiving the journal long after they had stopped paying their local dues. Office records had been negligently kept, and no one could tell just which past (and current) activities should be charged to Sigma Xi, which to RESA, which to *American Scientist*, which to Yale, and which to Baitzell's editorial work for Yale University Press. Creditors dunned both societies, and members' complaints were rarely answered.

Much worse than the inefficiencies that Clarence Davies had detailed almost ten years earlier, this dereliction shocked Prentice, and Sigma Xi's President Taylor and RESA's Chairman Compton, both aware that Baitzell had long known of their concerns, reacted angrily. In April 1952, they formed (with Joseph W. Barker, a member of the Sigma Xi Executive Committee and Compton's successor as RESA chairman) a joint Special Committee on Intersociety Finances and Budgets to finish Prentice's audit with expert help. In March 1953 the committee demanded that Baitzell leave his Sigma Xi and RESA positions immediately, but allowed him to

continue to edit *American Scientist* temporarily. Only "the pressure of other duties" was cited as the reason for Baitzell's resignation.

In selecting Thomas T. Holme, chairman of the Department of Administrative Sciences at Yale, to be Sigma Xi's acting executive secretary, Barker, Compton, and Taylor hoped to avoid the problems that had accompanied George Baitzell's service. At 40, Holme was young by Sigma Xi standards, having joined the Yale faculty only three years earlier as professor of industrial engineering.

Holme spent the summer of 1953 reviewing Baitzell's and Pegram's files, finding a worse mess than even Donald Prentice had realized. During the next few years, he restructured most Society operations, prepared an initiate booklet and a manual of procedure, and introduced automatic data processing systems. The Executive Committee soon realized that Holme brought to Sigma Xi what it had long needed, and in December 1953 the delegates at the annual meeting elected him to a six-year term as executive secretary.

Two months earlier, a temporary Committee on Publications cited Baitzell's age, then 68, as public grounds for his retirement from the editorship of *American Scientist*. By September 1954, Hugh Taylor had been named as Baitzell's successor. He soon announced plans for an Editorial Board, moved the editorial offices to Princeton, and with the April 1955 issue began a fifteen-year editorship. To minimize costs to the Society, Taylor agreed to serve for a while without pay.

Expansion and reform

Thomas Holme's efforts led Sigma Xi toward a truly national identity, as the Society and its chapters began to feel the influence of the tremendous growth of American science in the 1950s. For example, *American Scientist* advertisements recruiting engineers and scientists for federal defense contractors replaced those selling products, and articles focused on scientific and technical education. In 1955, President Joseph Barker called for further Society interest in this area, and the journal began publishing descriptions of chapter, club, and branch science fairs and camps, field trips and lecture programs, awards for students and teachers, and the like. The Soviet launch of Sputnik in October 1957 stimulated further concern, and C. Guy Suits, General Electric's vice president and director of research, gave the 1958 Procter Prize address on "Education and Science." Sigma Xi and RESA thus clearly had embarked in a new direction.

The societies, their journal, and their local groups also stressed other science-and-society issues in the 1950s and 1960s. These included national science policy and federal support for science and technology, scientific productivity and the organization and management of science and technology, the ethical implications of scientific research, the relation of science to the humanities, the problems of scientific documentation, and the international nature of science.

Meanwhile, both societies continued to grow. From 1953 through 1965, forty-two chapters, seventy-two branches, and many clubs were chartered, and Sigma

Xi's active membership grew from about 51,000 to almost 90,000. Not all members, however, approved of this growth rate, and the old debate about membership criteria and the proper balance between honoring and encouraging research resumed. The 1930 compromise had worked well for more than twenty-five years; a 1956 revision, recognizing the rapid multiplication of research fields, replaced the constitution's list of sciences with general categories of scientific work. Further changes reaffirmed chapter autonomy, clarified the status of clubs and associate membership criteria, and created a chapter-at-large to coordinate the election and promotion of members not affiliated with any chapter. These policies allowed Sigma Xi to weather later attacks on honor societies better than most similar groups did.

The Society's governance evolved as well. Thomas Holme's half-time position as elected executive secretary became that of a full-time appointed executive director. To draw further on available experience, the office of president-elect was established in the late 1950s, and mid-1960s changes called for the immediate past president to remain on the Executive Committee (which itself became the Executive Board) and established a Committee on Long-Range Planning that has since done much to chart the Society's course.

Meanwhile, a newly established Committee on Publications decided to discontinue *Science in Progress*. The books had long been losing money. Moreover, reviewers often complained that individual volumes lacked unity and purpose. In 1968, when the Society announced that the recently published sixteenth series would be the last, *Science's* reviewer noted that this "step . . . has long seemed overdue." But *Science in Progress's* demise represented Sigma Xi's only real contraction during the 1960s and 1970s. In fact, this decision came just as the Society began a major period of expansion and transition.

Sigma Xi's evolution was largely achieved under the active leadership of several eminent scientists and engineers, as a roster of national presidents during this period [see p. 551] well demonstrates. These men helped shape the four major reforms of the 1960s and 1970s: the introduction of national dues, the scheduling of independent meetings, the complete recasting of *American Scientist*, and the full democratization of the Society. As we shall see, the reforms in turn led to a diminution of the power of this small group of men.

National dues, which in 1966 replaced the assessments that local groups had paid since the 1890s, initially faced the objections of members who feared a stronger national office. But once enacted, they brought individual members into direct contact with the national Society, into which they were now directly inducted. This fundamental change reinforced its leaders' efforts to increase Sigma Xi's national presence and to keep accurate membership records.

The scheduling of independent meetings also met with opposition, but the change was clearly needed. Sigma Xi had met annually with the AAAS for almost sixty years, and Society leaders had long criticized this practice because it fostered hurried meetings, attracted less-than-fully-concerned delegates, distracted even committed delegates, and gave the impression that Sigma Xi was only an AAAS section. But apart from one successful

wartime meeting, any mention of independent conventions raised serious financial questions.

Several consecutive annual surpluses led Sigma Xi's leaders to suggest that the Society itself should underwrite the delegates' transportation, and so a trial independent meeting was held in 1967. This sixty-eighth convention succeeded beyond all their hopes, setting the pattern that Sigma Xi has since followed. Two and one-half times as many chapters and clubs sent delegates as in any previous year. Most delegates were officers of their groups, and not simply members who attended the AAAS meeting, and thus they were well informed about the Society's concerns. The convention was five times longer than most previous ones and thus gave the delegates greater opportunity to work together, increasing interest in Sigma Xi's governance and promoting a sense of unity. Panel discussions about national programs and a "Dialogue between Chapters and Clubs and the National Headquarters" also stressed Sigma Xi's national identity and inspired many delegates with program ideas for their local groups.

The third major innovation took place in 1970, when *American Scientist*—a 6-x-9-inch journal since its first publication in 1913 as *Sigma Xi Quarterly*—began appearing bimonthly in a larger 8-x-11-inch format. It also moved its offices back to New Haven, and in 1971 Jane V. Olson, a Yale University Press senior editor who had worked on *Science in Progress* and had then served as *American Scientist's* managing editor, became its new editor. The larger format could take advantage of new

Thomas Holme's efforts led Sigma Xi toward a truly national identity, as the Society and its chapters began to feel the influence of the tremendous growth of American science in the 1950s

production techniques. Greater use of color added much, as did Sidney Harris's cartoons, which first appeared in the March-April 1970 issue.

Meanwhile, the journal's content also changed. From the early 1970s, the typical article reviewed developments in a specific field and related the events to a broader scientific context. It differed greatly from the concentrated research papers of specialist journals and avoided the constricted focus of bench or field reports. Though still written by leading specialists, *American Scientist* articles were raised by extensive editorial attention to a stylistic level above most scientific prose.

American Scientist had thus become a journal through which researchers could communicate with the scientific community at large and the "average" scientist could follow the full range of current science. The transformation of *American Scientist* was expensive, of course, but convention delegates always defeated cost-cutting motions, believing that the journal spoke well for Sigma Xi and increased its stature in the scientific community.

The fourth major reform—the full democratization

of the Society—was much broader than the other three in its outlines and implications. Like most American institutions, Sigma Xi underwent tremendous changes in the 1970s that far surpassed those of the turbulent 1960s. All forms of authority were challenged, and honor societies were often assailed as elitist. At the 1970 AAAS meeting, demonstrators dressed as witches disrupted the annual Phi Beta Kappa–Sigma Xi address by casting a hex on both sponsoring societies. More meaningful criticisms came from Society members and led, during the 1970s, to the adoption of a governance system that today effectively involves all chapters and clubs. Just as it had in the past, the Society adapted to changes in its social environment.

Appropriately, the most influential criticisms emerged at the independent meetings—one of the important reforms of the late 1960s—where members came both to appreciate the Society's strengths and to believe that certain weaknesses required change. In particular, many members were disquieted by the way in which the relatively small circle of older leaders dominated the Society's affairs to the exclusion of other qualified individuals. Harvey A. Neville, for example, who had been president of Lehigh, succeeded Donald Prentice as treasurer in 1963, and nine years later, when Neville became president, Frederick D. Rossini—who had been Sigma Xi president ten years earlier—became treasurer. He resigned ten years later, to assume immediately a position created expressly for him—vice president–finance. Such practices had been common in scientific societies for decades, with nominating committees usually presenting just one name for each position and rarely hearing any nominations from the floor. But many members came to believe that, despite the great integrity of these men and the major services they had rendered, the nominating process should be more open.

Matters came to a head at the 1971 annual meeting. In response to requests by delegates to previous meetings, the Society's officers distributed committee reports in advance, introduced a resolutions committee to deal with formal statements, planned additional business sessions, and deferred votes on nominations and resolutions to the meeting's last day. In addition, Hugh Taylor, chairman of a previously appointed special committee on nominating procedures, introduced a resolution that called for sweeping changes, including reducing terms and requiring multiple nominees for most offices, restructuring the nominating committee, and establishing mechanisms for bringing potential candidates to its attention. Thomas Holme supported most of the proposals, but argued against one-year presidential terms and doubted the need for two presidential nominees. The type of leader that the Society needed would not, he claimed, take part in a contested election, and other committee members, aware of the trouble experienced by organizations like the American Chemical Society that held contested presidential elections, dropped this specific suggestion. But the committee strongly supported the rest of the proposal, including the one-year presidential term, and the meeting adopted it.

As part of Sigma Xi's increasing concern with science-and-society issues, the meeting meanwhile had heard an address by Melvin Kranzberg, founder of the

Society for the History of Technology. Entitled "Scientists: The Loyal Opposition," the talk analyzed scientists' roles in American society, and Kranzberg urged their greater involvement at all levels of decision-making. When the nominating committee presented its report later in the meeting and called for additional names, John W. Prados of the University of Tennessee rose and, citing Kranzberg's "splendid address," nominated him. The 300 delegates asked for a paper ballot and—some excited by Prados's action and others by Kranzberg's talk—overwhelmingly elected Kranzberg to the Executive Board. Prados's decisive action and the vote that followed demonstrated clearly that the Society was being opened to wider participation by its members.

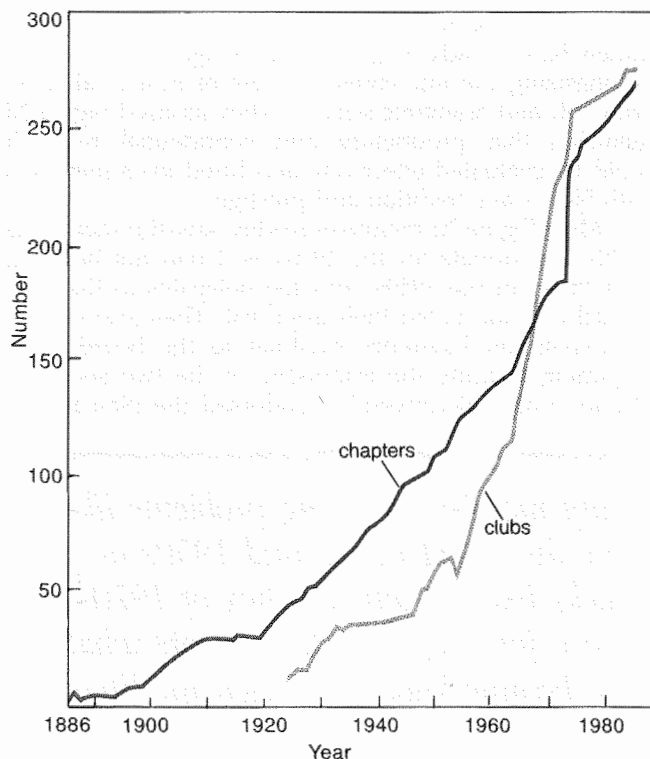
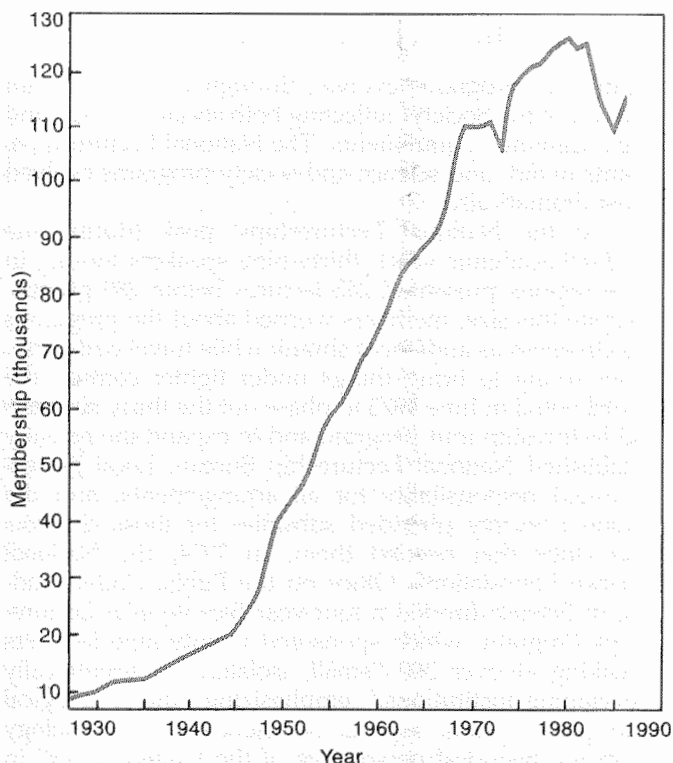
The years following saw other significant changes. Documents adopted in October 1972 provided formal mechanisms through which chapters and clubs could name candidates and revised the order of business at annual meetings. They also called for an enlarged Board of Directors and a regional governance structure. In this way, Thomas Holme hoped to link the national Society more directly with local chapters and clubs and expand the regional gatherings that had first been held in conjunction with the 1971 annual meeting. Later called regional assemblies, they assumed specific advisory and governing powers and encouraged delegates to raise issues that could not easily be dealt with by the larger Assembly of Delegates, in which "the control of the Society's organization, programs, and activities" was vested.

Other changes represented compromises among further democratization, representative (rather than direct) governance, and concern that the Society operate efficiently, drawing on its past leaders' experience. In 1974, for example, as the Board of Directors grew to twenty-six members, the Assembly created a seven-member Executive Committee. A complete reintegration of the Society's governing documents was finally accomplished in 1980, when, under the direction of Glenn V. Russell of the University of Texas Medical Branch, the constitution was revised and simplified by the removal of operational details to bylaws.

By 1980, then, or even earlier, the reforms of the 1960s and 1970s had done their work, and, as those who had promoted independent meetings had hoped, more members than ever before involved themselves in Sigma Xi activities. The more democratic Society that evolved had not necessarily been their immediate goal, but for the most part the Society's leaders seemed happy with the changes.

Reunification with RESA

The merger of Sigma Xi with RESA to form Sigma Xi, The Scientific Research Society of North America was another major part of Sigma Xi's development in the 1960s and 1970s. The path to union since the rejection of Hugh Taylor's proposal in 1952 was full of twists and turns. In the late 1960s, RESA had severed all formal links with Sigma Xi, although its national offices remained next door to Sigma Xi's and it continued supporting *American Scientist*, the National Lectureships, and the Grants-in-Aid of Research program. The high hopes its leaders had



Growth in active membership since the late 1920s (left) was greatest in the twenty-five years following World War II. Since then, losses and gains have alternated. Membership records for the Society's first forty years are fragmentary. Growth in chapters (right) has been remarkably steady through the years, with the great increase in 1974 from the addition of former branches of the Scientific Research Society of America. Records for clubs are much less reliable: many of the first groups formed in the 1910s met only informally, and a number of clubs have vanished over the years. There was a tremendous spurt in growth from the mid-1960s to the mid-1970s.

for RESA as an independent society were never realized, however, because, while many other scientific societies grew, RESA actually shrank, to about 10,000 members. RESA thus never achieved a national identity like that of Sigma Xi—meeting independently only once, and never collecting national dues—and conventions often were attended by fewer than ten delegates.

In June 1970 leaders of the two societies established a joint committee, and both Thomas Holme and Sigma Xi's Committee on Long-Range Planning urged them to consider merging. The next few years' deliberations differed markedly from those of the 1940s and early 1950s, as Sigma Xi's members of the committee—past presidents Wallace Brode (former associate director of the National Bureau of Standards) and Frederick Rossini, and Frank C. Croxton of the Battelle Memorial Institute—all knew the strengths (and weaknesses) of non-academic research. On becoming president in January 1971, Croxton stated "quite emphatically that I consider the early combination of the two into a unified Scientific Research Society of America a major objective." RESA also selected its rotating members on the joint committee with an eye toward cooperation.

By the middle of 1971 the committee had drafted a merger proposal, and that fall, after long debates, Sigma Xi's annual meeting and RESA's convention both voted ("overwhelmingly but not unanimously") to accept the principle of unification. Both charged the committee with implementing the principle and asked Holme and RESA director Bradford R. Stanerson to prepare the

united society's governing documents. Twenty years after Hugh Taylor's proposal had been vehemently voted down, his goal came into sight.

Though the joint committee readily agreed that all full and associate members of both RESA and Sigma Xi should retain their status in the new society, the status of RESA branches and the role of nonacademic scientists in the new society's governance caused much dissension. After negotiations almost collapsed in the spring of 1972, the committee agreed on the principle of branch evaluation—through which a select committee of leading RESA members would assess each local group and recommend

Like most American institutions, Sigma Xi underwent tremendous changes in the 1970s that far surpassed those of the turbulent 1960s

its status in the merged society—and strongly recommended that the new society's nominating committee should stress "appropriate representation" of nonacademic scientists. The governing boards of both societies that summer approved the merger plan.

Formal unification into Sigma Xi, The Scientific Research Society of North America required one more major step, however—the approval of the members and

local groups. Both societies' officers and the joint committee had already begun to campaign for approval, emphasizing the interconnectedness of industrial, government, and academic science. They assured Sigma Xi members that proprietary and confidential research could be evaluated effectively and lured RESA members with Sigma Xi's tradition and prestige.

Most Sigma Xi members readily saw the merger as highly appropriate for the 1970s as it had not been (in their view) in the 1940s, and the delegates to the 1972 annual meeting voted their approval. They also elected RESA chairman Lawrence Kushner to the Board, thus beginning to unify the leadership of the two societies. The RESA annual convention endorsed the plan in De-

Many members—citing problems like those discussed in the mid-1950s or attacks like the witches' hex of 1970—argued for programs to promote what soon became known as scientific literacy

ember 1972, and an early 1973 mail ballot approved it by a 6,532-to-3 vote. Soon afterward, the Branch Evaluation Committee completed its study of the 85 surviving groups (of the 103 that had existed) and recommended that 51 receive chapter charters and the rest be recognized as Sigma Xi clubs. The two societies formally merged on 1 January 1974.

The merger brought membership to an all-time high, but since many RESA members also belonged to Sigma Xi, the growth was less than some expected. In 1969, Sigma Xi had about 110,000 active members, and in 1974, just after the merger, membership reached about 117,000. (National headquarters also kept records on about 70,000 inactive members.) Once all former RESA branches were brought into the Society, Sigma Xi encompassed an even 250 chapters and about the same number of clubs. The Society's financial affairs expanded as well: from 1969 to 1974, its assets grew from \$867,000 to \$2,165,000, its annual budget rose from \$766,000 to \$1,470,000, and its endowment more than doubled (in large part because of William Procter's bequest to RESA), from \$216,000 to \$475,000.

This growth required greater activity at headquarters, which in turn created a need for greater space. Sigma Xi had been housed in several different buildings at Yale since 1941, and by 1970, as the merger with RESA neared and negotiations with Yale for longer leases and more space led nowhere, all agreed that something had to be done. Early in 1972, a building that seemed perfect was found in New Haven, and, following protracted financial and legal negotiations, Sigma Xi headquarters moved into its new offices in April 1973. The purchase price of \$800,000 was paid off in only three years by a combination of contributions and a one-time \$7 assessment of members. Since it has additional rentable space, the building has been an income-producing property for the Society.

Toward the second century

Sigma Xi's programs evolved through this period with the rest of the Society, reflecting both social concerns and organizational requirements. The National Lectureships, grants-in-aid, and science-and-society programs evolved most dramatically.

At the National Lectureships' peak (during the 1968–69 academic year), thirty-nine speakers touring in nine regions presented 245 lectures before 289 groups. Despite this size, members worried about the program's effectiveness as audiences shrank while travel costs rose. After trying to bring things under tighter control, the Board voted in June 1973 to phase out the thirty-six-year-old lectureship tour program and to expand the recently established National Lectureship Bureau. Local groups assumed responsibility for all arrangements, and the national Society provided subsidies for those chapters and clubs that needed them. In 1974, the National Science Foundation's Office on the Public Understanding of Science funded a four-year Bicentennial Lectureships Program, which sponsored twenty-nine lecturers speaking at over 300 "small, isolated, or scientifically developing institutions," emphasizing "the sociological and philosophical aspects of science and technology from the historical perspective of the United States" in their talks. Thousands of people heard these lectures, and the entire lectureship program thus continued serving those who needed it most. Its lower costs allowed the Society to focus on other programs.

The Grants-in-Aid of Research program continued for decades with few major changes, though Harlow Shapley, who chaired the oversight committee through 1969, continually worked to increase the funds awarded. Like the lectureships, the grants-in-aid program served best those at the edge of "big science," including many women scientists, researchers at predominantly black colleges, and those working in field sciences. Graduate students also benefited greatly, and successful scientists whose entry into research had been aided by Sigma Xi grants often supported the program most ardently.

Although some argued that the program made "only a trivial addition to the totality of US research," even those with "big science" interests acknowledged its help for younger scientists. Most Sigma Xi leaders believed that the program had established its niche, and in the 1960s and 1970s it attracted occasional large gifts. Dues increases in 1977 and 1981 explicitly allocated \$1 from each member for its support, and from 1979 all contributions not otherwise restricted went for grants. The program continues reaching out to all corners of the scientific community, and the National Academy of Science's 1983 decision to have Sigma Xi administer its own small-grants program testifies that the Society effectively fills this role.

Sigma Xi's current science-and-society programs owe much to its members' broader concerns and in particular to Harold G. Cassidy, a Yale chemist who succeeded Harlow Shapley as chairman of the Committee on Grants-in-Aid of Research. Long interested in philosophy and believing that all knowledge is related, Cassidy promoted what he called the unification of science, and at the 1970 annual meeting he convened an

informal evening "Session on the Health of Science." With no set agenda, those attending soon began discussing social concerns, and many voiced a vague uneasiness about the role of science in modern America, often tied to attempts to justify their research interests. Though not well focused, the concerns seemed serious, and the Society formed an ad hoc Committee on the Health of Science.

The 1971 annual meeting heard a talk on "Leonardo's Creativity in Science and Art" that addressed Harold Cassidy's philosophical concerns, and about 250 members attended another informal evening session. Though Cassidy opened by stressing his own interests, much discussion revolved around science education, science in the popular press, and other aspects of public understanding of science. Many members—citing problems like those discussed in the mid-1950s or attacks like the witches' hex of 1970—argued for programs to promote what soon became known as scientific literacy. Those attending grew excited as they gradually realized that others shared their concerns, and Melvin Kranzberg's talk the next day on "Scientists: The Loyal Opposition" reinforced the feeling. Kranzberg and V. Elving Anderson, a University of Minnesota geneticist active in science education issues through the Assembly of State Academies of Science, became with Cassidy major figures in Sigma Xi's emerging science-and-society programs.

The next several annual meetings (and *American Scientist* volumes) focused on other somewhat less controversial science-and-society issues, such as conservation and scientific responsibility and federal support of science and technology. The energy shortages of the mid-1970s led to several programs and articles on scientists as public decision-makers, which helped focus vague concerns about scientific literacy. Many thus saw the public understanding of science as an area in which Sigma Xi had a major opportunity, through both science education projects and activities aimed at adults.

In June 1975 the Society formed an ad hoc Committee on Public Understanding of Science, and by the next year, when Harold Cassidy became president, science-and-society concerns were an integral part of Sigma Xi's programs. Cassidy's *American Scientist* editorials regularly addressed his philosophical interests and science's role in determining the quality of life; several local groups and the national Society supported public television debates on such issues as the future of nuclear power; and the chapter-at-large began awarding grants to clubs to promote public understanding of science in their communities. The 1977 annual meeting approved the creation of a standing Committee on Science and Society, thus institutionalizing concerns in the area. The changes in programs during the 1970s bewildered some, but a series of presentations at the 1979 annual meeting organized by M. Patricia Faber of Barat College brought many ideas together.

As the 1970s closed, many Sigma Xi members saw a bright future. The decade's democratization, the successful merger with RESA, the new national headquarters building, and especially the expanding programs all seemed signs of a healthy Society. And yet some of the Society's leaders saw things differently, and the Commit-

tee on Long-Range Planning asked Lawrence Kushner and M. Patricia Faber to consider "Whither Sigma Xi?" Though sharing little scientific background, Kushner and Faber readily agreed that Sigma Xi faced three major (and interrelated) kinds of problems: demographic, economic, and attitudinal. Their analysis sketched details—a declining college-age population, double-digit inflation, and many researchers' increasingly narrow interests—but argued that the era's social problems had led many scientists to realize that they could not ignore the implications of their work. Faber and Kushner concluded that Sigma Xi's science-and-society activities provided the programs scientists needed to express their concerns.

But such programs required nationally recognized leadership, which the Society was having trouble attracting. At the same time, many chapters at major research universities found the Society's traditional activities irrelevant to their members' interests and were among the most inactive. Faber and Kushner proposed several specific actions, of which two had major influence. One recommended that the Society "woo more of the well-known scientists into positions of prominence." The second urged the Society to stimulate the programs with the greatest potential for increasing Sigma Xi's national role.

C. Ian Jackson succeeded Thomas Holme in 1981 as executive director. An English-born geographer, Jackson had taught at the London School of Economics and then served in the Canadian civil service and the United Nations Secretariat. Soon after assuming his new position, Jackson took the first of several trips around the country, eventually visiting over 100 chapters and clubs. During these tours, he came to realize that national programs and local activities usually operated with little or no coordination. Most members thus saw little connection between the national Society, which they often identified with *American Scientist*, and their local group.

Rather than simply repeating traditional tenets about chapter and club autonomy, Jackson stressed what he called the Society's confederal nature. He began to

Like the lectureships, the grants-in-aid program served best those at the edge of "big science"

alter the function of headquarters, from simply managing the national Society's affairs and publishing its journal, to helping promote the activities of its many local groups. Jackson enlisted the aid of M. Patricia Faber, who knew the range of chapter and club activities better than anyone, to revise procedures at headquarters, and he recruited a director of program development, Evan R. Ferguson, charged with "maintaining and developing links between the headquarters office and the 500 chapters and clubs," especially for "activities under the heading of 'Science and Society.'"

After visiting 117 local groups, Jackson called his first annual report "The 118th Iteration." More detailed

than any previous portrait of Sigma Xi, it dealt with all aspects of the Society, stressed its strengths and weaknesses, suggested both long- and short-term solutions to many problems, and set the Society's agenda for the next five years. A report by the National Executive Service Corps, a consulting group for nonprofit institutions, reinforced Jackson's conclusions and stressed Sigma Xi's status as an honor society. It urged Sigma Xi to use its special traits to deal with the "selective suspicion" of science that had emerged during the 1970s. Such activi-

Sigma Xi faced three major (and interrelated) problems: a declining college-age population, double-digit inflation, and many researchers' increasingly narrow interests

ty, the report argued, would not only increase the Society's visibility among scientists and in each local group's community, but would also attract many new members.

An important program initiative had its roots in this recommendation. As scientific fraud received much public notice, some believed that scientists had grown more dishonest. A September 1983 *American Scientist* article on "Honor in Science" by Ian Jackson and President John Prados detailed the problem, sketched its causes, and suggested twelve specific steps that Sigma Xi might take. Some involved the Society, such as a revised pledge to stress scientific integrity and a mechanism to revoke membership. Others focused on individuals, urging members to stress "honest skepticism" in their work. Finally, the article suggested that Sigma Xi, as the honor society for scientific researchers, develop both a code of ethics and a set of principles spelling out responsibilities of scientific authorship. In 1984, the article was expanded into a forty-page booklet, also entitled "Honor in Science," that has been widely used in a revised version.

Both Jackson's "118th Iteration" and the National Executive Service Corps report looked to the Society's approaching Centennial celebration, for which planning began in 1982. A first planning committee focused the event on the future, and later groups, under the leadership of V. Elving Anderson, developed the theme "Plan a Celebration, Plant a New Tradition." By awarding Centennial planning grants and distributing program checklists to chapters and clubs, they set their goal as 500 Centennial celebrations, rather than one.

Another program—A New Agenda for Science—emerged during the planning sessions, and many national leaders see it as the centerpiece of Centennial activity. Led by Thomas F. Malone, chairman of the Committee on International Membership, and President-elect Lewis M. Branscomb, the Society developed a kit soliciting opinions about the recruitment and training of scientists, the content and character of research, and the internal and external factors that help shape science. Grant assistance for the project was provided by the National Science Foundation. Chapters and clubs receiv-

ing the kit were asked to consider such questions as how much (if any) of science is patentable, how national security concerns should affect scientific publication, how limited resources for science should be distributed, how science should respond to immediate social needs, and how scientists should handle publish-or-perish pressures. The results of this wide-ranging debate and of a subsequently developed questionnaire that was sent to some 10,000 individual members are being reported to the Science Policy Task Force of the US House of Representatives, and they will also serve as the focus of the October 1986 Centennial celebration at the National Academy of Sciences in Washington.

This program resembles past Sigma Xi attempts to influence American science policy, and the leaders of the 1930s and 1940s, such as George W. Stewart and Harlow Shapley, would applaud it. But unlike earlier attempts, which were generally centered on the views of the national leaders, the New Agenda initiative looks to the Society's confederal nature to seek what Thomas Malone has called "the views of John and Jane Q. Scientist." In the best tradition of chapter and club autonomy, the national staff expects to learn from local groups and to bring their initiatives and ideas to the Society at large. This attitude promises more than any particular program as Sigma Xi embarks on its second century. ❧

Note on sources

This history represents a radical condensation of a book-length typescript on deposit at Sigma Xi headquarters, awaiting revision for publication. That typescript includes much social and biographical context and contains full documentation; here I want merely to sketch the range of sources I used. Historians seek archival material where possible, and in the attic of 345 Whitney Avenue I found files started ninety years ago by James McMahon, the Society's first secretary, and continued by Henry Baldwin Ward, his successor. Other useful documents stored at headquarters include a small collection of William Procter letters, a number of miscellaneous papers gathered by Raymond J. Seeger in the early 1970s, typescript copies of minutes of many Board and committee meetings, and the massive files created by Thomas T. Holme and C. Ian Jackson. Other manuscript sources include the following archival collections: at Harvard, the Harlow Shapley and Kirtley F. Mather papers; at MIT, the Philip Morse papers; at Yale, chapter records and a small file of Henry Shaler Williams papers; at Columbia, the George B. Pegram papers; at Cornell, chapter records, material documenting the Society's founding, and the bulk of the Henry Shaler Williams papers; at the University of Illinois, chapter records and the Wilbur Luce, Henry B. Ward, and Charles Zeleny papers; at the University of Chicago, the James Franck papers; and chapter records at Rensselaer Polytechnic Institute, Case Western Reserve University, the University of Missouri, the University of Texas Medical Branch at Galveston, and Worcester Polytechnic Institute.

I spoke at length (in person and by telephone) with many who helped shape Sigma Xi's development, including V. Elving Anderson, John I. Ely, M. Patricia Faber, Thomas T. Holme, C. Ian Jackson, Lawrence M. Kushner, John W. Prados, Bradford R. Stanerson, Charles A. Walker, and Talbot H. Waterman.

The full run of *Sigma Xi Quarterly* and *American Scientist* proved immensely valuable, as did the published proceedings of the Society's earliest conventions and the supplemental annual reports issued in the 1940s and early 1950s. Henry Ward's *Quarter Century Record and History* and Edward Ellery's *Half Century Record and History* provided much useful detail, but I found the chapter histories they included more valuable. In addition, the published and unpublished histories of several chapters—especially those at the Borg-Warner Research Center, University of Minnesota, Ohio State University, Stanford University, and the University of Texas Medical Branch—shed light on many important issues. I hope that other chapters and clubs will prepare similar documents, as many well deserve historical treatment.



October 9, 1886
Winthrop Oglivie Discovers
Sigma Xi