

The Twentieth Century

This is the university that added to its traditional curriculum such subjects as applied mathematics, foreign languages, political science and economics—all very new at the time. This is the university that introduced multidisciplinary education well before the term was even invented. This is the university that established the country's first school of medicine, then realized that theory could not be separated from practice and consequently developed the system of the teaching hospital now in general use. For all these reasons the University of Pennsylvania has been a true pioneer, and as we look back today, it is virtually impossible for us to estimate the contribution this institution has made to free intellectual development.

M. Valéry Giscard d'Estaing,
President of the French Republic
on receiving an honorary doctorate
from the University of Pennsylvania
May 19, 1976



Alfred Newton Richards: Biomedical Research

The Agnew Clinic

David Hayes Agnew (M.D. 1838), professor of surgery (1871–1889). When his clinic at the University Hospital was photographed in 1886, perhaps by Eadweard Muybridge, then working on campus, neither teacher nor assistants wore surgical garb. In Thomas Eakins' great group portrait, based on this photograph, which hangs in the school of medicine, the celebrated surgeon, who attended President Garfield at the time of his assassination, is shown wearing a white gown while operating for cancer of the breast.

The change in "the art and science of medicine" between 1875 and 1889 is depicted in two paintings by Thomas Eakins: "The Gross Clinic" at Thomas Jefferson University's medical college and "The Agnew Clinic" of the University of Pennsylvania.¹ In the decade and a half which separate these two paintings, surgical procedure had radically altered. By the time the Pennsylvania professor was portrayed at work with his associates, white gowns had replaced the black frock coat and gold watch-chain of both the earlier work and the photograph on which "the Agnew Clinic" had been based. An awareness of antisepsis is at least suggested in the later composition despite the lack of surgical gloves. Other improvements in medical practice and teaching had come about since the days midway through the nineteenth century when Leidy's associate, William Hunt, had described the state of the school as one of "innocuous desuetude" and "medical dotage or senility."²

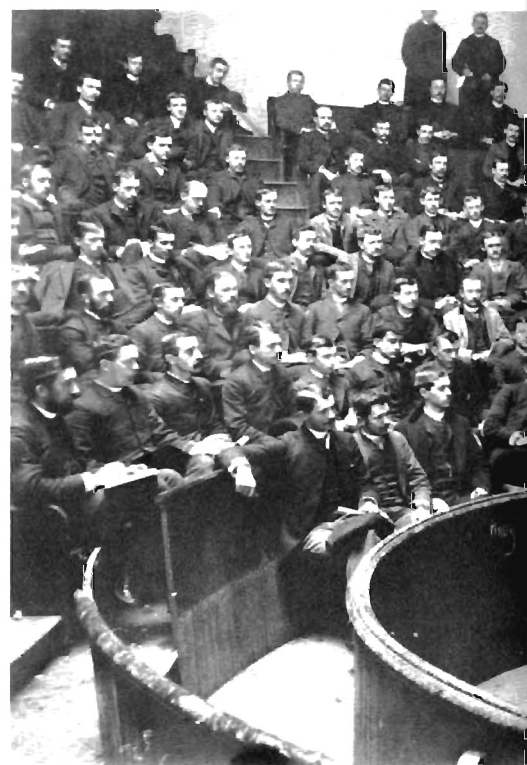
The many reforms which had been instituted led, however, to a problem of a different sort. In the words of Charles Harrison Frazier, who was dean in 1910, the atmosphere had become one of "self-satisfied complacency and scientific stagnation."³ A few years earlier, Provost Charles Custis Harrison, Frazier's uncle and namesake, had expressed the fear that the University's school of medicine was not keeping up with the rapid advances being made in basic science. "A modern medical school," he wrote in a report to the trustees, "should be a centre of research in the science of Medicine. Nor should research be fostered solely in the spirit of advancement, but also because it insures activity on the part of the instructor, while stirring up increased interest on the part of the student."⁴ Although both Frazier and Harrison had progressive views, their own close relationship was an example of the inbreeding at the University in those days, particularly in the faculty of medicine, which contributed to the conservatism of America's oldest medical school.⁵

The practice of looking only to a narrow circle of alumni to fill chairs had been breached in 1884 when the brilliant, informal Canadian physician William Osler was appointed to the professorship in clinical medicine. Although he did not stay in Philadelphia long, five years were enough for

him to have an effect on the teaching of medicine, for "Osler breezes were felt everywhere in the old conservative medical center."⁶ It was almost the first time in more than a century that a man who was not an alumnus of either the College or the school of medicine had been offered a medical chair. Osler even suspected a friend in Montreal of playing a practical joke on him and delayed responding, "fearing that Dr. Shepard had perhaps surreptitiously taken a sheet of University of Pennsylvania note-paper to make the joke more certain." Even so, there were doubts about the suitability of an outsider, and trustee S. Weir Mitchell was commissioned to examine the prospective candidate in London. In Osler's account, great importance was attached to his table manners, particularly his method of disposing of the pits while eating cherry pie.⁷ The professor, who arrived by streetcar rather than carriage and, far from having a polished delivery, "sat on the edge of the table swinging his feet and twisting his ear instead of behaving like an orator," was something of an oddity. During his brief tenure, however, he left an indelible mark on the school of medicine. Refusing to practice, he enthusiastically gathered students for pathological studies in the "half-way house" between the Blockley Hospital in West Philadelphia and the burial ground of Potter's Field.⁸

Osler's use of the microscope for clinical studies and his emphasis on the autopsy as a mean of furthering medical knowledge was an object lesson for the students in more ways than one. Much could be learned from the distinguished physician who gleefully pointed out to his students the evidence of a mistaken diagnosis which had come to light at the post mortem. The diagnosis in question had been made by Osler. On another occasion, he is reported to have expressed regret that he would not be present at his own autopsy, as it was the case he knew better than any other. Although he saluted the school of medicine as the "premier school of America" and Philadelphia as the "*Civitas Hippocratica*," he departed in 1889 for Johns Hopkins whose medical school, when it opened, immediately set standards superior to those elsewhere in America. Osler later moved from Johns Hopkins to become Regius Professor of medicine at Oxford.

When Provost Harrison addressed the trustees in the first years of the twentieth century on the subject of research, he was influenced by Simon Flexner, the brilliant young professor of pathology who had come to the University from Johns Hopkins in 1899. In those days, few of the medical faculty had any interest in Harrison's hope of "stirring up interest" through research. During the four years Flexner remained at the University, pathology became the most scientific of the preclinical departments. Even while he was successful convincing Harrison of the necessity for scientific investigation at a university, Flexner was debating whether to leave for New York to head a risky new venture—the recently



Joseph Leidy in His Anatomy Class, 1888
The last of the great natural philosophers of his age, Leidy was also of the generation that taught anatomy by didactic demonstration. Hundreds of students listened to him as he lectured from the "bull pit."



chartered Rockefeller Institute for Medical Research. To his former chief, William H. Welch, he wrote of his "agreeable position" at the University of Pennsylvania, although he was aware of tacit and continuing opposition to his ideas. He felt the entrenched position of the older Philadelphia physicians, along with the school's lack of endowment, as cause for concern.⁹ Taking up the challenge at the Rockefeller Institute in 1903, Flexner was responsible for overseeing the development of one of the major research organizations in America. Exactly half a century later, the founder of biophysics at the University of Pennsylvania, Detlev Bronk, professor for twenty years, first director of the Johnson Foundation, and trustee of the University, became the third head of the Rockefeller Institute for Medical Research (now the Rockefeller University), after having served as president of Johns Hopkins.

Three years after Simon Flexner joined the Rockefeller Institute, his brother, Abraham, began to look into the nation's medical schools as part of an examination of professional education in the United States supported by the Carnegie Foundation for the Advancement of Teaching. What came to be known as "The Flexner Report" was the single most influential study of American medical education of this century and its influence continues to be felt after seventy years. The evaluation of the University of Pennsylvania's school of medicine pinpointed not so much sins of commission as those of omission. Its limitations became apparent in comparison with the most forward-looking school of the time, Johns Hopkins. Despite the national stir the report had created, the complacency with which it was received at Pennsylvania is reflected in the fact that no mention of the report's findings appears in the Minute Book of the trustees.¹⁰ One reason for such indifference was undoubtedly the security engendered by the unrivaled position the school had occupied right up to the twentieth century, when the need for research was recognized. A recent statistical survey of leaders in the first three centuries of American history concludes with the statement that, over this period, the University of Pennsylvania "at the professional level trained more than twice as many 'noteworthy' doctors as Harvard. Indeed," the comparative study goes on, "Pennsylvania contributed more noteworthy physicians than all the medical colleges and hospitals of New York, and almost as many individuals as Harvard, Yale and Princeton put together."¹¹

Even before the Flexner report was published in 1910, Provost Harrison had been preparing for reforms in the school of medicine. He hoped to replace older department heads with younger, scientifically oriented faculty. With support from trustees, principally physician and novelist S. Weir Mitchell, rather than with medical school faculty approval, he recruited new professors from Chicago, Harvard, California, and Northwestern. Selected for their scientific reputation, these men were probably the choice of David Edsall, the dynamic young researcher and

alumnus of the medical school already occupying the chair of therapeutics and pharmacology. When he agreed to accept the position as the new head of medicine, Edsall became the central figure in the attempted reforms. But the progressive movement backfired: of the new appointees one alone stayed on at the University. This was Alfred Newton Richards, "the youngest and most inconspicuous of the group and the only one without medical training in an institution that prided itself on clinical excellence."¹² In the face of opposition within the medical school and the reaction which followed the resignation of Provost Harrison, Edsall departed for Washington University, later becoming dean of medicine at Harvard. Having reached his eighties, trustee S. Weir Mitchell also resigned at this time, tired as he wrote to his friend Sir William Osler of the "constant hot water in the faculty."¹³

Although the reformers accomplished little at the time, the young pharmacologist they brought to Philadelphia was to become one of the giants of biomedical science of the twentieth century. During the course of his long life, Richards attracted to his laboratory some of the brightest young physicians and scientists of the time and was active in the administration of medicine at the University as well as of national medical programs. In 1931, when the office of vice-president for medical affairs was created, Newton Richards and T. Grier Miller conducted a *Survey of Medical Affairs*. In the twenty years since Richard's arrival, the situation in the school had changed along the lines projected by the earlier reformers, not through coercion but largely as a result of his own example as a dedicated teacher and leader in research. Over the same period, the attitude to outside grants for scientific investigation had undergone an equally significant change. Fifteen years earlier, the medical school had missed an opportunity for financial aid at a time when Abraham Flexner was presiding over Rockefeller funds for the support and development of medical schools, in part because of reluctance to risk outside interference.

The problems inherent in a dependence on outside funding were only too well known to Richards, who at eighty-two addressed himself to this very question in a speech on the fiftieth anniversary of the John Morgan Society.¹⁴ Nonetheless, after World War II, when the United States government was most favorable to funding medical research, in large part owing to the wartime success of programs directed by medical administrators such as Richards, the University's school of medicine was this time in a position to benefit from federal support. In the words of one of Richards's earliest associates, Isaac Starr, first professor of therapeutic research at the medical school:

When such funds became available, in amounts undreamed of, the Medical School of the University of Pennsylvania which he loved so much and for which he worked so hard was out of the doldrums; research was the order of the day, and it was of a

Hugh Wynne Free Quaker (1897 edition) by S. Weir Mitchell; frontispiece illustration by Howard Pyle *Physician-novelist S. Weir Mitchell (1829–1914) was educated at the University Grammar School (the old Academy), and had studied but not graduated with the College class of 1848. He was awarded the A.B. in 1906 long after being elected a University trustee (1875). A Civil War surgeon and a Foreign Member of the Royal Society, widely acclaimed for his treatment in private practice of nervous disorders, he is also known as a writer of poetry and prose. Two of his best-known novels are Hugh Wynne Free Quaker (1896) and The Red City (1907).*



"IN THE PRESENCE OF WASHINGTON,"

quality that quickly attracted liberal support. So the school was in readiness for the expansion in medical education and research that shows no signs of abating, and he had done more than any other to bring this about.¹⁵

In 1967, the Kober medal was presented to Starr by Joseph Stokes, Jr., who at the time he became chairman of pediatrics had made it the first full-time position in one of the oldest strongholds of part-time clinical teaching.¹⁶ Playing on the name of the colleague he was honoring, Stokes described Starr as "part of a planetary system with its central sun . . . Dr. A. N. Richards." A photograph of 1928 shows Richards, like another Pennsylvania professor, Alexander Dallas Bache, appropriately known as "The Chief," surrounded by his planets, all of whom later became professors and deans in medical schools around the country, "while still responding to the . . . gravitational or magnetic pull at the center so warmly acknowledged."¹⁷ A future vice-president for medical affairs and a Nobel laureate appear in the photo; two among his entourage were knighted and one ennobled.¹⁸ Richards attracted this brilliant group by the interest and excitement of his personality and work at a time when little money could be paid to those who entered his laboratory.

If Newton Richards was eminently capable of attracting good young scientists to the University of Pennsylvania, he himself had benefited from the scientific and humanitarian example of his professor at Yale. Science and learning had been brought alive for him there by Russell H. Chittenden, who taught physiological chemistry to future medical students. When Richards was unable to come up with the needed tuition for medical school, Chittenden offered him a fellowship for further research and study. After receiving his M.A. from Yale, Richards went to Columbia for his Ph.D. and, the same year, became the first Rockefeller Institute Scholar. His treatment of his associates reflected his own experience with the man he described as "the personification" of physiological chemistry, whose laboratory was the "American fountain head." Chittenden believed in letting his students work out their problems alone, and Richards maintained: "That, I think, was the beginning of any independence of thought or action which I have since developed."¹⁹ He observed the same pedagogical principle with the people who later worked in his own laboratory. They learned a simple procedure for experimental research and one which Richards followed himself. "In planning your approach to a problem," he would say, "ask yourself the question to which you want the answer. Make the question so specific that you can devise an experiment to answer it."²⁰

It was in 1910 that Richards was called to the University of Pennsylvania on the advice of David Edsall, who had heard him give a paper some years earlier. Although associated with men such as Chittenden, Christian A. Herter, and John Howland, Richards at thirty-

HUGH WYNNE

FREE QUAKER

SOMETIME BREVET LIEUTENANT-COLONEL ON
THE STAFF OF HIS EXCELLENCY
GENERAL WASHINGTON

BY

S. WEIR MITCHELL, M.D.
LL. D. HARVARD AND EDINBURGH

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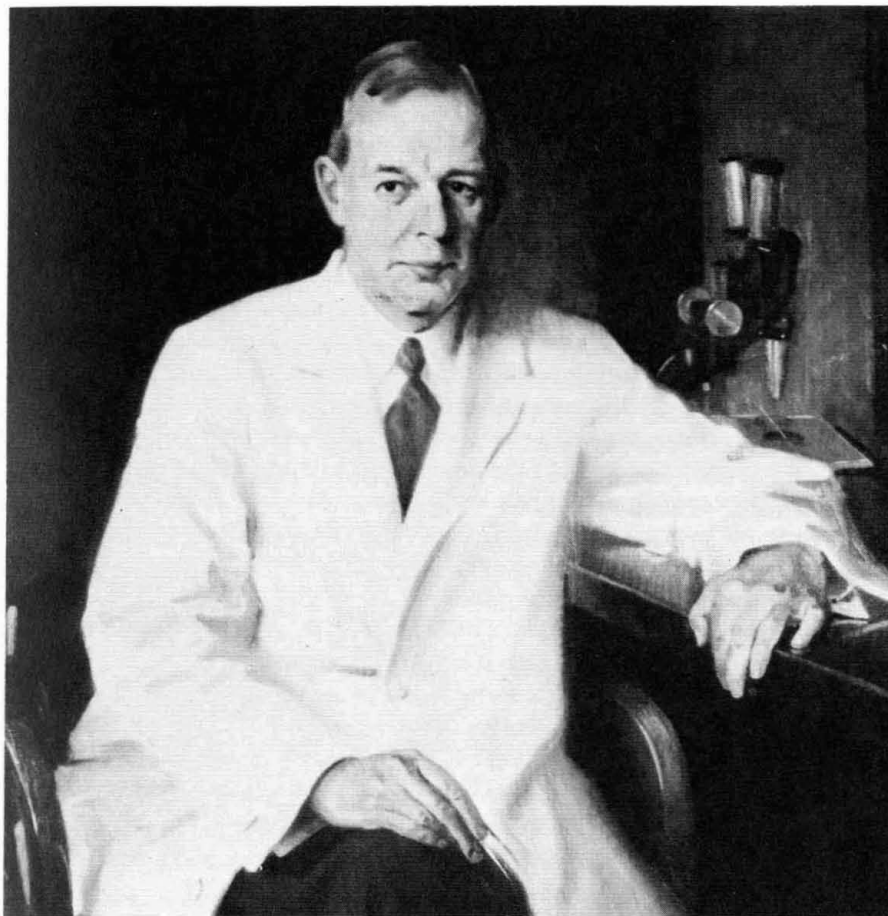
William Osler (1849–1919)

by William Merritt Chase
*Professor of clinical medicine at the University of Pennsylvania (1884–1889). Born in Canada, he received his M.D. from McGill, where he was professor before coming to the University. He later organized the medical service at Johns Hopkins Hospital, before it opened (1889), and became physician-in-chief there (1893). Appointed Regius Professor at Oxford (1905), he was created a baronet in 1911. Although he published numerous articles—over 300 while at the University—and many books, including *The Principles and Practice of Medicine* (1892), he wished to be remembered principally as one who “taught clinical medicine on the wards.”*

four had principally exemplified himself by the methods he had devised for teaching the area of basic science which was only beginning to be known as pharmacology. The traditional subject—*materia medica*—had been steadily decreasing in importance and, after much neglect, the subject had fallen into disrepute. “Is your son so stupid that he can’t do anything better than waste his life on Pharmacology?” was the question asked of Carl Schmidt’s father when the man who followed Richards as chairman of pharmacology joined the department in 1919.²¹ Having learned little about teaching the subject from Oswald Schmiedeberg, the recognized “Grand Master of Pharmacology” whose methods for organizing a laboratory course in the new discipline he had observed in Strasbourg in 1903, Richards was forced to start from scratch when he returned from Germany to create an elective course in pharmacology at Columbia. Before coming to Philadelphia, he had also set up a teaching department in the subject at Northwestern medical school. During his first year at the University of Pennsylvania, his concern with teaching as well as his editorship of the recently established *Journal of Biological Chemistry* left him precious little time for research.

As a matter of fact, Richards’s investigative projects, including the experiment which brought him international fame, frequently grew out of his efforts to improve his teaching. Gifted young collaborators soon presented themselves, and some of the University’s brightest medical students were so impressed by Richards as teacher, scientist, and person that they took time out to work in his laboratory.²⁷ The first student to do this was Cecil Drinker, afterwards dean of Harvard’s school of public health. With his cooperation, Richards created an improved perfusion pump for pumping liquids through tissues and kept a mammalian brain alive by this means. He next decided to perfuse the kidney in an attempt to determine the function of this organ. In teaching renal physiology to medical students a problem arose because there were conflicting theories concerning the formation of urine. There were no experimental data to show whether urine was formed by selective secretion in the kidney of only those constituents found in the bladder, or by nonspecific filtration of the blood followed by selective reabsorption of the valuable constituents leaving only waste products behind.

A first round of experiments in Richards’ laboratory had been interrupted by World War I when Richards was invited to London to collaborate with Sir Henry Dale, “the Pope of Pharmacology,” with whom he produced, among other things, a classic study on the action of histamines—compounds which occur in all mammalian tissues. After demobilization, Richards’s laboratory started up again in earnest. With Joseph Wearn, a postdoctoral fellow from one of Harvard’s teaching hospitals, the Peter Bent Brigham, who was sent to him by Drinker, Richards set up “one of those simple, direct, unambiguous experiments that re-



Alfred Newton Richards (1876–1966)

by J. C. Johansen

Professor of pharmacology at the University of Pennsylvania (1910–1946). Educated at Yale (A.B. 1897, M.A. 1899), and Columbia (Ph.D. 1901), where he taught physiological chemistry and pharmacology at the College of Physicians and Surgeons, he was brought to the University as a promising young research scientist by David Edsall. In addition to his discoveries concerning the action of chloroform and histamine, his most notable contribution resulted from his famous experiments on the kidney. Chairman of the Committee on Medical Research of the Office of Scientific Research and Development during World War II, he took the action necessary to make penicillin commercially available as well as supervising important work on malaria. He was vice-president in charge of medical affairs at the University (1939–1948) and president of the National Academy of Sciences.

searchers dream of but seldom attain."²³ The question asked on this occasion was: "Does glomerular filtrate contain substances that are not present in bladder urine?" The experiment to answer it which Joseph Wearn and he dreamed up over a bottle of beer involved micropuncturing the renal tubule. Not only did this permit substances to be injected directly into the encapsulated network of capillaries called the glomerulus but, by the same procedure, the fluid contained in a glomerulus could be withdrawn for chemical comparison with bladder urine.

Without the aid of sophisticated modern micro-manipulators or radioactive isotopes, pipettes were placed in functionally different regions of the kidney and a "vanishingly small" volume of fluid was analyzed. Since the minutest vibration disturbed fluid collection, Wearn describes working at night when the only visitors to the laboratory were a friendly mouse and an occasional cockroach. Richards frequently joined him in his vigil.²⁴ Their discovery in glomerular fluid of chemicals not found in

bladder urine constituted conclusive evidence in favor of the filtration-reabsorption theory. In their own published account: "Direct testing of the fluid eliminated by the frog's glomerulus proves the assumption which was made by the earliest of the modern students of renal physiology, that a protein-free, watery fluid is separated from the blood-stream as it passes through the glomerular capillaries."²⁵ This finding was modified when they later showed that small protein molecules were filtered by the glomerulus but were subsequently reabsorbed by the tubules.

When the results of the investigations were reported at the meetings of the American Physiological Society in 1922, they shared the limelight with another vital discovery: the isolation of insulin by Banting and Best. An expert in the field has described the Richards-Wearn experiment as "the most significant single original contribution in the field of renal physiology," and the research was crucial for modern nephrology. Without it, advances in medicine such as the development of the artificial kidney could not have come about. "After again reviewing the accomplishments of Dr. Richards and his colleagues," concludes this commentator, "I wonder once again, as I am sure have others, why Dr. Richards was never honored by the award of a Nobel prize."²⁶

If this award was never made for the field of renal physiology in which he worked, Richards's other degrees and decorations have led to the comment that "we know of no other American medical scientist who has been so greatly honored both here and abroad."²⁷ On the occasion of his honorary Doctor of Science from the University of Pennsylvania, he posed for a photograph with a frog in one hand and a caduceus of live snakes awaiting glomerular puncture in the other. One of his "boys" composed a limerick to celebrate the occasion:

There once was a Richards named Newton
Who collected degrees high fallutin'
A.B., Ph.D.
M.D., Sc.D.
And there's more yet to come, you're damn tootin'.²⁸

Arthur Walker, to whom the verse is attributed, could only have suspected in 1925 the numerous awards and rewards which would follow. The scientist who had been prevented from studying medicine for financial reasons received the M.D. from the University of Louvain and honorary degrees from many universities. In 1947 he became president of the National Academy of Sciences, of which he had been a member since 1927. Invited to give the Croonian Lecture before the Royal Society in 1938, he was elected a Fellow in 1942, the fourth Philadelphian to become a Foreign Member after Benjamin Franklin, David Rittenhouse, and S. Weir Mitchell.

When Richards departed for England in 1938 to give the Croonian Lecture, he and his family were accompanied by Detlev Bronk. During the journey, Bronk recalls, Richards fretted about the additional experiments



Simon Flexner (1863–1946)

by Adele Herter

Professor of pathology and morbid anatomy at the University of Pennsylvania (1899–1903), and member of a famous family of scientists and educators. Born in Louisville, Kentucky, graduated in medicine at the University of Louisville (1889), he taught pathology at Johns Hopkins before coming to the University. Resigned to become the first director of the Rockefeller Institute for Medical Research which, under him, became one of the most active institutions in the world. His discoveries include a dysentery bacillus which bears his name, and he made important contributions to the treatment of meningitis and poliomyelitis, as well as to the area of toxicology. Among numerous honors he received an honorary Sc.D. from the University (1929).

which ought to have been done and the literary quality of his paper which he feared was "not good enough for a British audience." And every day aboard a slow ship crossing the Atlantic, he revised his manuscript. When he presented his material in the crowded lecture hall of the Royal Society in Burlington House, he spoke with humility and, following the Quintilian dictum, "not so much that his audience could understand, but so that they could not misunderstand." At last, looking up at a final slide of a chart which summarized the experiments, he was heard to whisper: "My God, what a lot of work." The response was thunderous applause, and the man sitting next to Detlev Bronk remarked: "If he does not get a Nobel prize, the Prize will never again be worth getting."²⁹

One result of Richards's international scientific fame was his tardy election to the American Philosophical Society in Philadelphia. "He has been a member for years," was the response when the vice-president was asked why Richards had not been elected and, on being assured that this was not the case, "incredible, he is one of the great American scientists; the greatest Philadelphia scientist since Franklin."³⁰ The omission was immediately rectified, and Richards later became vice-president himself, although he declined nomination for president. In addition to these academic accolades, Richards received many awards and medals, including the Philadelphia Bok Award in 1937 for the greatest contribution made by a local resident. Among the decorations which his wife gave to the University is the Medal of Merit presented to him by President Truman and the insignia of an Honorary Commander of the Order of the British Empire which he received from King George VI.

These last awards were made in recognition of his contribution to a wholly different area of research and administration during World War II. In 1941, Roosevelt wrote: "I hereby appoint you as Chairman of Medical Research created by Executive order establishing the Office of Scientific Research and Development. In this capacity you shall receive no salary. . . . Cordially yours."³¹ Many years later, the director of the Office of Scientific Research and Development, Vannevar Bush, who had informed Richards of his new assignment, recalled that "even under this mild provocation he became profane." Detlev Bronk, who was in his office when Richards received the call from Bush, remembers only that Richards' brief acceptance was followed by the modest hope that he merited the confidence placed in him.³² It appears that infractions of the prohibition against profane language—and tobacco—at the seminary in Stamford, New York, where Richards had started his education, were among his few faults. In view of the hardship he is said to have endured as a result of the wartime restrictions on cigarettes, it seems unlikely that he should have been a fire hazard in Washington, as reported by one associate, because of his habit of trying to keep four or five cigarettes burning at the same time.³³ Nonetheless, among the original apparatus used to collect fluid from



Detlev W. Bronk (1897–1975)

Professor of medical physics at the University of Pennsylvania (1929–1949), director of the Institute of Neurology (1936–1940), and trustee of the University of Pennsylvania (1954–1975). The first director of the Johnson Foundation at the University of Pennsylvania, he left to become president of Johns Hopkins (1949–1953) and was afterwards president of the Rockefeller Institute for Medical Research, which he helped rename the Rockefeller University (1953–1968).

the glomeruli and tubules of frogs, snakes, salamanders, guinea pigs, rats, and opossums is an ingenious device for holding experimental material carefully constructed in a Lucky Strike tin.³⁴

Richards is remembered for his courage, integrity, both of the “scientific and the garden variety,” as well as his great modesty.³⁵ This last quality is evident in the final article he wrote on the subject of penicillin production in the United States. Little is made of his own important role in getting the drug into production, and he does not mention that Sir Howard Florey, who first obtained the antibiotic in relatively pure form, had spent a year in his laboratory. As early as 1944, however, the importance of Richards’ contribution was fully recognized in an editorial of the *British Medical Journal*. Without his efforts, Sir Alexander Fleming’s discovery, as well as Florey’s signal victory, would have remained ineffectual at the time of greatest need. The fact that, when the allies invaded Normandy, penicillin was available in sufficient quantities to save the lives of the wounded was the direct result of Richards’ decision, as chairman of medical research, to promote production by natural fermentation. The editorial points out that, as director of government research programs, Richards need not have involved himself in problems of production. Furthermore, the decision to go ahead with the natural fermentation process when at any moment a synthetic process could make the plant for growing the mold obsolete, rested entirely with A. N. Richards.³⁶

Even Florey, who visited the States in the summer of 1941 in the hope of persuading American manufacturers to start mass production of the drug, was confident that synthesis was at hand. That Richards should have stood almost alone in making the far-reaching decision to proceed with natural fermentation was predictable in view of his lifelong adherence to the principle of going from the known to the unknown one step at a time.³⁷ Within eight months, the drug had been tested on some ten cases. Its experimental application to chronic war wounds is described in Richards’s own laconic report:

Treatment of military casualties by penicillin began on April 1, 1943, when Dr. Champ Lyons, a member of the Chemotherapy Committee of the National Research Council, was authorized by Surgeon-General James Magee of the U.S. Army to inaugurate at the Bushnell General Hospital, Brigham City, Utah, a programme of treatment of patients from the Pacific area.³⁸

Behind this flat statement of fact lies the whole touchy question of permission for civilians to carry out experimental treatment on soldiers. As a result of Richards’ ability to listen carefully and to take decisive action, the necessary sanction was speedily obtained. Dr. Lyons actually arrived in Utah with a plan and a program before the commanding general had been fully informed.³⁹ Consequently, the *British Medical Journal* could well claim in the last stages of the war that “Dr. Richards has the reward

of knowing that as the result of his efforts the lives of very many American and British wounded are being saved every day."⁴⁰ By D-Day, allocation of penicillin had been made to 1,000 civilian hospitals, and by the end of the war the use of the drug had increased sharply to 650 billion units per month. "By this time—but not before," writes an observer, "British and American chemists had finally synthesized minute amounts of penicillin, but the cost of producing 100,000 units by natural fermentation had become less than the cost of putting it into an ampule, and there was—and is—no prospect of economic advantage from synthesis."⁴¹

During World War I, Richards had spent some time setting up a field laboratory in France. At that time, Base Hospital 20 at Châtel Guyon was staffed entirely by University of Pennsylvania-trained doctors and nurses. When Richards was summoned to Washington during World War II, the Pennsylvania contingent was also reactivated under the command of I. S. Ravdin, Harrison professor of surgery. After preliminary training in Louisiana, U.S. General Hospital No. 20, as it was now called, with its 73 commissioned officers all recruited from faculty and alumni, departed for northeastern Assam. Here, "a few shacks in a muddy and malarious valley" were rapidly transformed into a 2,000-bed hospital delivering superior medical care. As described in a contemporary report, "by its intelligence and skill it reduced the mortality of our troops to a record unequaled by any nation in the annals of war."⁴²

The physicians who returned to the University of Pennsylvania at the end of the war were to become international leaders in such fields as ophthalmology, radiology, dermatology, and surgery. Now nearly seventy, Newton Richards himself reassumed the post he had held since 1939 of vice-president of the University in charge of medical affairs. Even after his retirement, he remained active as emeritus professor, was made a trustee of Merck & Co., and served as a member of the first Hoover Commission on the Organization of the Executive Branch of Government. In the late fifties, he could still be described as "a man who has been living at least three full lives for more years than he wants to remember."⁴³ In 1960, the most important work of modern architecture on campus, designed by Louis I. Kahn, was dedicated in his honor. The Alfred Newton Richards Medical Research Building has become one of the architectural attractions of Philadelphia and the United States, and it is a fitting memorial to a great scientist who died a few days after his ninetieth birthday, having devoted more than two-thirds of his long life to medical science and administration at the University of Pennsylvania. A note penned by Carl Schmidt on a copy of the memoir he wrote for the Royal Society sums up the feeling of a generation of scholars and physicians who came under the influence of Newton Richards: "There will never be another like him and we were extremely fortunate to have been where and when we were."