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GEORGE WASHINGTON CORNER

1889—1981

A Biographical Memoir by
ELIZABETH M. RAMSEY

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Biographical Memoir

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George W. Corner

GEORGE WASHINGTON CORNER

December 12, 1889–September 28, 1981

BY ELIZABETH M. RAMSEY

THE NINE DECADES OF George Corner's life spanned a period of profound change in world history. Equally dramatic and fundamental developments in scientific history took place in that period. Upon the segment of science which was his own field, reproductive anatomy and physiology, Corner made an indelible imprint.

In keeping with the broad scope of his talents and interests Corner's mark was also made upon a wide range of other fields. In addition to being a distinguished scientist he was an internationally recognized medical historian, a biographer, a scholar, a humanist and philosopher, a leading medical educator and administrator.

The ninety years of Corner's life were incredibly full and richly productive.

SCHOOL DAYS

George Washington Corner, the third in succession to bear that name, was born on December 12, 1889, in Baltimore, Maryland. He was descended from a long line of Corners, of English origin, who lived in Maryland from the mid-17th century. His immediate forebears moved to Baltimore around 1850 and pursued prosperous careers in business, establishing a successful family mercantile and ship-

ping firm. All generations of the family were staunch Methodists and practiced the firm and restrained life pattern characteristic of devoted Church members. But teetotalism and the eschewing of theater, dancing, and so on, did not prevent a buoyant, happy and unaffected family life.

Numerous family members, both men and women, served as leading laymen in various church capacities, while their strong sense of civil obligation led them into responsible community positions. His grandfather was one of the early trustees of Johns Hopkins Hospital and president of the board of the Samuel Ready School. His father was a trustee of Goucher College, president of the Baltimore YMCA, and followed his own father as president of the Samuel Ready School.

Corner's maternal heritage was also English-derived and Baltimore-nurtured through several generations. Methodism and commercial activity were prominent on this side too. His Evans grandfather was a pioneer in the food packing business and designed the machinery for large-scale canning of oysters.

Neither Corner's parents nor any of his close relatives had advanced academic education, but all were well read and studious with great respect for learning. Their homes had well-stocked libraries and their friends and associates were professional people and community leaders in Baltimore and more widely throughout the United States.

Family feeling and stability were particularly strong among the Corners and those with whom they married. Our George (whom we may identify as "Dr. Corner," as he was the first medical man in the family—though the title anticipates our story by some years!) was surrounded by a closely knit circle of kinfolk, embracing his parents, his two siblings, two sets of grandparents, and a bevy of aunts and uncles and cousins of varying degrees of relationship.

The home in East Baltimore where Dr. Corner was born was close to the newly established Johns Hopkins Hospital and Medical School. East Baltimore at that time was a quite remarkable neighborhood of congenial families constituting in effect a small village within the larger Baltimore community with which in fact they had little affinity. A graphic account of turn-of-the-century life in this little enclave, more southern than northern like all of Maryland, is incorporated in Dr. Corner's two autobiographies (*Anatomist at Large* and *The Seven Ages of a Medical Scientist*). Both make delightful reading and provide classic vignettes worthy on their own merits of inclusion in any treatise on American life. That fifty years later he remembered it all in such vivid detail is testimony to its influence in the building of his own tastes and the judgments that characterized his career.

Young George enjoyed his early school days, at first in the local public schools, later at the Boys' Latin School. He did well enough, if not brilliantly, but his standard education was significantly augmented by voracious reading of the magazines and books present in abundance on his family's bookshelves and especially by the cultivated and interesting conversation of the numerous distinguished guests whom his parents entertained.

There was little science taught in his elementary schools, but avid curiosity and a high degree of manual dexterity led him to fabricate simple electrical and optical instruments, and summers on the working farm of favorite relatives, one a veterinarian, gave him an early taste of natural history and animal medicine.

Above all, an abiding interest in the classes was instilled in him by a gifted teacher at the Boys' Latin School, where he also got a firm grounding in English and mathematics.

COLLEGE, MEDICAL SCHOOL AND POSTGRADUATE WORK

His interest in the classics led Corner, upon entering Johns Hopkins University, to register as a prospective major in the classics. However, a growing interest in biology manifesting itself very shortly prompted him to change his major to science at the beginning of his sophomore year.

In retrospect he was able to put his finger on the actual circumstance that triggered the decision, namely, reading an article on Texas cattle fever by Theobald Smith published in an old issue of *U.S. Department of Agriculture Reports*, which he found in his veterinarian uncle-in-law's files. It "opened for me the doors to a whole new world of scientific exploration. Before I finished reading it I knew that I wanted to become a biologist." His judgment was confirmed when, in the first week of the college fall term, he "sat down to work with a microscope for the first time in my life. There was no longer any question about my place in the world; this was where I belonged. . . . I was intellectually at home at last."

One course in his senior year made a lasting impression upon him. It was a course in psychology given by John Broadus Watson. In it Watson told of his own work and that of other members of the new "behaviorist school" of which he was a recognized leader and expressed the belief that understanding of the higher levels of human thought must be based upon study of man as an animal, subject to the same physical laws as other animals. This concept stayed with Corner, influencing his future work and thought.

In the summer following graduation from college, still undecided how to shape his future course into medicine or zoology, Corner spent several productive months at the U.S. Fisheries Laboratory in Beaufort, North Carolina, where the Johns Hopkins Biology Department had special privi-

leges. There he became intensely interested in protozoa, which were to be found in abundance in Beaufort Sound. He collected them and studied them closely, working particularly with *Cothurnia*. At the end of the summer his observations and sketches were published in *Notes from the Johns Hopkins Biological Laboratory*, 1909, and thus became his first scientific publication.

As he worked that summer he came to recognize that by nature he was more comfortable with simple organisms than with complicated ones, with embryos rather than with adult bodies. Thus the scales of his decision tipped toward zoology for his life's work, but the worldly wisdom of a surgeon cousin—to the effect that with a medical degree one could still be a biologist yet have a practical profession to fall back on—won the day, and in October 1909 he entered the Johns Hopkins Medical School.

The years 1909–13 were an ideal time to be at the Johns Hopkins Medical School. It was then the ranking medical school in the United States with a faculty roster that included some of the most distinguished men in their fields in both basic science and clinical departments. The student body was relatively small, seventy to eighty per class, and equally superior. Both men and women came from all parts of the country and were college and university graduates. Instruction was carried out stimulatively on modern lines. This was particularly so in the Anatomy Department under Franklin P. Mall. Small, tidy, quiet rooms had supplanted the traditional large, dirty, noisy dissecting hall. Lectures were a very minor feature compared to the emphasis upon individual initiative in dissecting and reading. Corner promptly established himself as an enthusiastic student. Very soon he launched upon a research project that occupied him throughout his four years of medical school: investigation of the previously unknown minute structure of the pancreas.

Medical history had always been of prime interest at Johns Hopkins and Corner early commenced attendance at the meetings of the Medical History Club. Additionally, he was given access to a fine collection of classic works on the history of medicine housed behind locked doors in the physiology building. Vesalius's *Fabrica*, Diemerbroeck's *Anatomy*, and De Graaf's *De succo pancreaticum*, among others, gave background to his growing interest in the honored drugs Mithridatium and Theriac, on which he prepared an essay that he presented to the Medical History Club.

Faithful attendance at all the lectures, laboratories, clinics, ward duty, and the multitudinous requirements of a superior medical school still left Corner with free summers. In 1911 he made a European tour that included attendance at courses at the University of Freiburg-im-Breisgau and widened his Baltimore-based horizon by a walking tour in the Black Forest and visits to a number of German and French cities.

In the summers of 1912 and 1913 he served as a volunteer medical assistant at the Grenfell Medical Mission in Battle Harbor, Labrador. This provided some adventure and splendid experience in basic medical practice in a frontier environment. His success was such that several offers were made to him to establish a practice in an arctic community.

A highly important byproduct of the Grenfell summers was meeting an attractive young New England lady, Betsy Lyon Copping, a volunteer school teacher at the Mission. She eventually became Mrs. Corner.

In planning his course after medical school Corner had to choose between two appealing opportunities. As a member of the upper segment of the graduating class he was entitled to consideration for an internship in one of the hospital's clinical services. He selected gynecology under

Professor Howard Kelly and was accepted. At the same time Professor Mall offered him an assistantship for teaching and research in the Department of Anatomy and urged him to build a strong foundation in embryology and reproductive system physiology before setting forth upon a clinical career. This argument and the opportunity offered prevailed and Kelly agreed to postpone the gynecology internship for a year.

During the year in anatomy Corner tried his wings as a teacher with good success. At Mall's insistence he also embarked upon a study of the development of the corpus luteum of the ovary.¹ His animal model was the sow, a nearby slaughter house providing a wealth of fresh material. Mall, whose interest in early human embryos would later culminate in his establishment and directorship of the Carnegie Department of Embryology, hoped to use the corpus luteum as a measure of the age of early embryos. This hope proved false but Corner learned a great deal about pregnancy in the sow, which would prove useful to him later on.

In the following year, 1915, during his internship in the Department of Gynecology, Corner had excellent training under leading specialists in gynecology, surgery, anesthesia, and patient care. But as the year went on he had increasing doubts about his temperamental fitness for a career as a clinician. He also began to be concerned by the observation that despite superior skill as surgeons and teachers, the best gynecologists knew remarkably little about the physiology of the female reproductive cycle. Worst of all, little research was being done in the field.

With the conjunction of these two considerations, and especially because he was developing ideas about how such physiological research might be conducted, Corner was in a highly receptive state of mind for a proposal from Herbert Evans, one of the members of Mall's staff with whom he

had become friendly and for whom he had particular regard. Evans had just been appointed professor of anatomy at the University of California School of Medicine in Berkeley, and asked Corner to accept an instructorship in his department. As Corner reflected in his autobiography, "I accepted Evans' offer with a comfortable feeling that I had found the way to a career."

BERKELEY AND TWO MORE YEARS AT JOHNS HOPKINS

From the standpoint of our present, late twentieth century knowledge, it is difficult for us to appreciate the paucity of knowledge about reproductive system phenomena available in the years prior to World War I. The factors controlling the menstrual cycle, the time of ovulation, the origin and function of the corpus luteum, when and how the embryo implants in the endometrium—all were unknown. It was to the elucidation of these mysteries that Corner now proposed to devote his talents and his energies. And step by step through the years, he did so.

One may roughly chart his course by saying either that he progressed from the sow to the monkey to man or that his progress was from anatomy to physiology then via pharmacology and endocrinology to therapeutics. Some of the work was done alone, some with distinguished colleagues. And always, combined with research, were the two other great interests: teaching and medical history.

Corner enjoyed teaching and was exceedingly successful and popular both in the classroom and on the lecture stage. He once calculated that he had given his lecture on "Medicine in Chaucer," by request, twenty times between Los Angeles, California and Oxford, England! But beyond these aspects, teaching was to him a significant duty. The problem "research or teaching," which harasses our present medical schools, was never a problem for him. At the time, when

he decided against clinical medicine as a career, he expressed regret at no longer being "directly helpful to ailing people," but he confidently undertook "the responsibilities of the scientist-teacher: unswerving devotion to the search for knowledge, faithful guidance of younger intellects." From this credo he never deviated.

The love of medical history combined easily and usefully with teaching. Aside from his own scholarly work in the field he inaugurated courses for students that were well attended and in several cases established lifelong interest in medical history and the founding of recognized rare book collections. Furthermore, into all his routine courses in anatomy he injected provocative accounts of ancient ideas and concepts and frequently required a simple thesis on historical aspects of work in hand from each student.

The four years in Berkeley found him active upon the first stages of his projected career. Evans was pleased to find him an eager and popular teacher and administrator helping to set the operations of the department upon a strong and progressive base. Corner in turn relished the contract with an active and able staff under a brilliant head. Evans was able to obtain for him the equipment and animals (sows) necessary for his research and, as a first accomplishment, Corner succeeded in showing that the sow's fertilized ovum undergoes maturation in a fashion similar to that of the few other animals in which the process had been observed. This lent further weight to the opinion that the sow is a valid animal for study of the mammalian reproductive system. Continued studies of the corpus luteum advanced the understanding of that organ substantially and answered an old question as to the origin of the luteal cells: both granulosa and theca interna contribute to their formation.

The keen interest and pleasure of participating in the

life of the vast western university was enhanced by having his wife join him. They had been married in New Hampshire in December 1915, and their son was born in San Francisco a year later. California had indeed become the Corners' home—but not for long.

In 1919 a compelling call came from Lewis Weed, who had just been appointed to succeed the late F. P. Mall as professor of anatomy at Johns Hopkins. Weed wanted Corner to join him as third in rank in the department with very favorable arrangements for teaching and facilities for research. Corner accepted, returning once more to his native city and alma mater and entering an exciting and productive era of his career.

Weed's department was a hotbed of activity in both teaching and research, staffed by such experts as Florence Sabin, George Wislocki, and Sidney Cunningham, among others. Once more the convenient propinquity of Hohman's Slaughter House to the medical school made it possible for Corner to obtain so large and so well timed a series of uteri of pregnant sows that by 1921 he could report the whole sequence of uterine changes occurring in this mammal during the reproductive cycle as well as those occurring in the corpus luteum. A classic article in the *Carnegie Contributions to Embryology* records the complete story.

Corner was now ready for the next step, namely, to turn his attention to a menstruating animal. He selected the *Macacus rhesus* as the most suitable one, and with funds Weed obtained for him bought eleven females which he housed on a balcony in the Hunterian Laboratory of the Anatomy Department. This was the first experimental breeding colony of monkeys in the United States and numerous important discoveries were made employing it. His organization and maintenance of his monkey colony set the standard for such work in primate research centers to the present

day, including his insistence upon daily observation to detect the onset of menstruation. Without meticulous routine the most dramatic finding made at this time in his colony might have been missed. In an animal autopsied on the fourteenth day of the menstrual cycle an ovum was recovered from the oviduct, en route from the ruptured ovarian follicle to the uterus. This was the first such find ever made in a primate on a known date in the cycle and it confirmed the monkey's time of ovulation beyond question.

The series of findings in the monkey colony established the similarity of the primate cycle to that of the sow, with the exception of the lack of estrus at the time of ovulation in the primate and the greater menstrual bleeding occurring when the primate corpus luteum degenerates. Jumping ahead many decades, it may be noted that the modern procedures of artificial insemination, "test-tube babies" and surrogate motherhood, have been developed upon the basis of these classic discoveries and others to follow.

Another of the monkey studies, aimed at establishing the relationship of the onset of menstruation to the state of the corpus luteum, failed of its purpose because the females did not ovulate though they had fairly regular menstrual cycles. However, from this came recognition of the phenomenon of anovulatory menstruation, subsequently confirmed as occurring in young females, human as well as monkey.

In the spring of 1923 Corner received a most appealing and flattering invitation to become professor of anatomy at the medical school to be founded in Rochester, New York.

The years after the First World War saw a great ferment in the field of medical education with strong efforts made to implement the recommendations of the famous Flexner Report of 1910. To some extent this was being realized by reorganization of existing schools, but in two cases of which

Rochester was one, entirely new medical schools were to be established in universities which previously had not had one. Underlying plans at Rochester were of the most liberal and progressive sort; good funding had been procured and search was being made for young, gifted men with vision and enthusiasm. Corner accepted the offer.

ROCHESTER

Corner's choice of the title *Seven Ages of a Medical Scientist* for his definitive autobiography was highly appropriate, for his life's activities did indeed fall into a number of clearly demarcated compartments; this, despite the consistent, unifying theme of his devotion to biology and scientific research, first recognized in that revelation of "belonging" when he sat down to the microscope as a college sophomore.

The Rochester "Age" lasted for eighteen years and was the most active and creative of his career. One research project after another marked the period, leading to a flood of definitive publications.

The transition from associate professor at Hopkins to full professor and chairman at Rochester was a greater leap than such steps usually are. Corner did not climb the departmental ladder slowly rung by rung in the traditional way. Furthermore, he went from a well-established, liberal and progressive department to a nonexistent one in a nonexistent medical school. The opportunity to tailor his anatomy department to his heart's desire was coupled with the responsibility of doing so and making it work. But he was ready for the opportunity. His scientific training had been excellent and he had some experience of administrative work. His philosophy of science had been matured by long thought and association with outstanding colleagues. An additional element in the leap was that he was shifting from

the role of brilliant young investigator to that of a still young but established scientist with an increasing reputation and a growing circle of scientific friends. He was ready for this new role, too, and for the social ramifications of the future. He had a genius for making and keeping friends based upon a genuine interest in people and an ingratiating personal modesty. He had a quick wit and a kindly sense of humor. He was agreeable both as guest and host.

Corner's first Rochester year was actually not spent in Rochester. His selection as professor of anatomy was made while the new medical school was still in the planning stage. Although the generous funding by George Eastman and the Rockefeller-supported General Education Board was in hand the actual building would not be ready for use before September 1924. It was therefore arranged that Corner should spend a preliminary year in Europe at the school's expense. However, George Whipple, Corner's great and admired friend since college days, had already taken over as the future dean and so, before he left for Europe, Corner, as the first of the professors to be appointed, was drafted to help Whipple with the planning for the school: the physical plant, the staffing and course organization, the assembling of a library, student selection, and so on. He left for Europe on June 9, 1923.

The Corner family spent most of the year 1923-24 in England. In London Corner worked for some months in the laboratory of Ernest Starling. A growing curiosity about the possible role of smooth muscle in the uterus and uterine tubes prompted him to study the action of heart muscle since it seemed possible that the action of this muscle might be similar to that of smooth muscle in the genital tract. It was a great opportunity to do so in one of the world's leading centers of physiological research where Starling kindly welcomed him. Though the work did not result in publish-

able data Corner learned techniques and basic facts that were of use later.

He had pleasant and valuable contacts with such English scientists as Starling himself, Sir Arthur Keith, Edgar Adrian, A. V. Hill, J. P. Hill, F. H. A. Marshall, Zuckerman, and John H. Teacher in Glasgow. Many of these friendships were lifelong.

Charles Singer, the renowned medical historian, encouraged him to enlarge his activity in history and to undertake a full-scale history of anatomy. This he did, relishing the luxury of original sources in British libraries. The final product was his first book, *Anatomical Texts of the Earlier Middle Ages*, published in 1927 by the Carnegie Institution of Washington. He also wrote a brief history, *Anatomy*, for the *Clio Medica* Series, which appeared in 1930.

The Corners spent the latter part of the European year on the Continent. Corner continued his observations on muscular action at the University of Strasbourg in G. Schaeffer's laboratory, studying specifically that of the uterine horns in sows. There he was greatly interested in meeting Ancel and Bouin, predecessors to his own continuing study of the corpus luteum.

Upon his return to Rochester, Corner launched at once upon the final preparations for his Anatomy Department, its physical layout and the curriculum. The enthusiasm and excitement of creating a new medical school animated everyone involved. The faculty, as selected under the aegis of the wise and respected president, Dr. Rush Rees, was a mutually compatible group of already experienced and distinguished men having vigorous, farsighted opinions of the duty and opportunity presented for progressive medical education. Generous funds were available, and the faculty were given wide latitude for independent thinking and planning. The independence was particularly welcome to Corner, who

appreciated the lack of "hampering tradition" and of supervisory constraint by predecessors.

In setting up the workplan of the Department of Anatomy, Corner put gross anatomy into the hands of Robert Kyle Burns and neuroanatomy into Wilbur Smith's, retaining histology for himself. In the histology course he incorporated many techniques he had learned from F. P. Mall, Florence Sabin, and Herbert Evans, whereby the often dry subject could be brought to life by use of fresh tissues to supplement the traditional "class slides." He greatly extended and elaborated this technique, creating a dynamic course that was a favorite of the students and one of his own paramount interests and a source of pride.

A number of Corner's good friends appeared as the faculty roster was completed. In basic science there was of course Whipple, Bloor in biochemistry, Bayne-Jones in microbiology, and Fenn in physiology. In the clinical departments, Norton in surgery; McCann, internal medicine; Wildon, gynecology and obstetrics; and Clausen, pediatrics. The intellectual stimulus of working with such a group fired ambition and outstanding accomplishments resulted.

In a biographic sketch prepared some years after leaving Rochester Corner listed the major projects that he and the members of his department addressed during his seventeen years there. They included: continuation of the reproductive cycle studies in monkeys; demonstration of anovulatory menstruation in women; identification of the relation of endometrial changes in pregnant rabbits to embryonic implantation rather than to activity of the corpus luteum; isolation and preparation of progesterone; discovery of lactation-inducing property of anterior pituitary extracts; development of a hormonal theory of menstruation; and demonstration of the action of progesterone on uterine muscle.

Central to these research activities was the work on the

corpus luteum continued through many years and leading to the historic identification, isolation and preparation of the hormone progesterone. Commenting upon the series of experiments that resulted in the discovery, Corner made a statement in his autobiography that merits quotation in full since it epitomizes his methods of thought and action which motivated him throughout his career and led to his commanding position in his field:

Philosophers of science have had much to say in recent years about serendipity, which *Webster's Dictionary* defines as a "gift for finding agreeable and useful things not sought for." An old adage says, however, that chance favors the prepared mind. In the discovery of progesterone serendipity played no part, nor did our well prepared minds need the aid of chance. We carefully thought out in advance every step we took.

For Corner a very gratifying aspect of the progesterone work was the collaboration with Willard M. Allen who completely shared his point of view about how the experimental program should be set up and carried out. Allen had come to Rochester in the new medical school's second year. He had been excellently trained in chemistry at Hobart College and at Rochester he led his class in anatomy and biochemistry. Excited by the opportunity to work with Corner he accepted a fellowship that stipulated that he drop out of medical school for one year and teach in the Anatomy Department while collaborating with Corner. It may be inserted here that Allen eventually completed his medical education and has had a successful career as obstetrician and gynecologist, chairing the department at Washington University in St. Louis, and currently resides at the University of Maryland.

The technical aspects of the progesterone experiments are detailed in a series of brief, simple reports in scientific journals. The quiet, factual statements of dramatic results of great significance and impact upon society were charac-

teristic. One must read between the lines to realize that it were this work that earned him the title, "Father of the Hill," bestowed by an eager press. There have also been many other ramifications of the Rochester work that have been of far-reaching effect in gynecologic practice and therapy.

In several published tributes to Corner, Allen recorded the excitement inherent in the work and his vast admiration of his senior collaborator's modesty. Two points he loved to emphasize: Corner's refusal to allow his name to appear on any published paper unless he had been an active participant in the work reported, and his quiet statement when the question of patenting progesterone came up, "Doctors of Medicine do not patent their discoveries." In his mind the hormone belonged to the public.

Basic to the high regard and personal devotion that Corner's associates felt for him was also his attitude toward the practical aspects of scientific research. He loved to roll up his sleeves and get to the heart of a problem. He regarded his associates and assistants as "coworkers," and at Rochester as time went on and plans permitted he adopted his students into the same fellowship.

During these years medical history was not neglected. His own studies were continued and he became internationally recognized, resulting in invitations to membership in medical history societies and to extensive lecturing. In 1930 a lecture on "The Discovery of the Mammalian Ovum," originally presented at Northwestern University Medical School in Chicago, was repeated at four other universities. A second lecture that year dealt with the rise of medicine at Salerno in the twelfth century. In 1936, upon invitation from the Royal College of Surgeons in London, he gave the prestigious Vicary Lecture reporting further on Salernitan surgery.

At the medical school he organized a medical history club that was popular throughout the school and the hospital. To it he attracted speakers from the medical school in all departments and from among the city physicians, as well as nonmedical people knowledgeable in relevant topics. In his honor the club was named the George W. Corner Medical History Club, and is so known today.

At the request of the dean he organized and supervised the building of the medical school library and the establishment and maintenance of its collection. In time, the designation Curator of the Medical Library was added to his official title of Professor of Anatomy.

The growing reputation of the young Rochester medical school brought a long succession of visitors from all over the world. An impressive list of students who would later attain distinction came to work specifically with Corner: Asdell from Cambridge; Waddell from London; Saiti from Tokyo; Bunster from Chili; Hoffmann from Düsseldorf; and Inés de Allende from Argentina, to name a very few, indicating the worldwide distribution of their origin.

In addition, with the spread of his personal connections, Corner was called upon more and more for participation in learned societies and for service as board member and officer; the American Association of Anatomists of which he was secretary-treasurer for eight years and president for two; the International Committee on Anatomical Nomenclature, chairman; the National Research Council's Committee for Research in Problems of Sex, chairman; the list goes on. For some years he also served as editor of the *American Journal of Anatomy*.

Corner's activity on the Committee for Research in Problems of Sex, plus concern for the instruction of his own adolescent children, prompted him to write two small books, *Attaining Manhood* and *Attaining Womanhood*, which were

published in 1938 and 1939 and achieved wide acceptance and use.

As time went on Corner received a number of invitations to take over prestigious chairs in other schools as they fell vacant. After due consideration he refused them all. His decision was influenced both by his pride in the Rochester Medical School that he had helped build and his satisfaction with its continuing standards, especially those of his own Anatomy Department and his course in histology, and especially by his desire not to interrupt in any way the flow of his research work. The whole pleasant pattern of life in Rochester was another not inconsequential consideration. But, in the fall of 1939, the irresistible call came. Vannevar Bush, president of the Carnegie Institution of Washington, offered him the directorship of the Department of Embryology in Baltimore. It was an exceedingly difficult decision to leave Rochester, but conclusive arguments were the prospect of a wider field of activity and influence and the thought of directing the laboratory that had been founded by Franklin Mall, his own first mentor in research. Following Mall, George L. Streeter had made the department into the world's foremost center for embryologic research. It had become a veritable mecca to a succession of visitors from this country of embryos to participate for longer or shorter periods in the research projects under way.

THE CARNEGIE EMBRYOLOGICAL LABORATORY

Corner accepted this call in 1940 and returned to his native city, where he found a pleasant house and was surrounded by kinfolk and good friends. A pleasing welcome home was the invitation to be a trustee of the Samuel Ready School of which both his grandfather and father had been president. This too he accepted, becoming president him-

self in due course. Interestingly enough, George Streeter had also been a trustee of the Ready School.

At the Department of Embryology Corner inherited a small, well-organized, closely knit organization with a history of distinguished research behind it and important projects still in hand. Two of the senior staff members remained from the Streeter days. First, there was Carl Hartman, the famous "raccoon man" and director of the monkey colony. The colony was actually the lineal descendant of the one Corner established many years before on the balcony in the Hunterian Laboratory. Under Hartman it provided the embryos upon which he and Streeter and Chester Heuser constructed the brilliant demonstration of monkey development from the two-cell stage to the end of the embryonic period, the first such complete description in a primate. Hartman remained until 1941 when he went to the University of Illinois in Chicago.

The second to remain was Chester Heuser, who stayed until his retirement, devoting his extensive knowledge of embryology and his masterly skill in dealing with young embryos to the preparation of the great Hertig-Rock embryos. That project, initiated by Streeter and enthusiastically continued by Corner, saw the famous pathologist-gynecologist team in Boston gradually obtain a complete series of human embryos representing almost every day of the first three weeks of gestation. The precious specimens were sent to Baltimore (often carried by hand for total safety) where Heuser prepared them for sectioning, modelling and eventual publication.

E. M. Ramsey's study of the anatomy and physiology of placental vasculature, employing timed monkey pregnancies from Hartman's colony and operative specimens from worldwide sources, was continued, Dr. Corner himself per-

forming the vascular injections in several cases, a use of his unforgotten surgical skills which he greatly enjoyed.

To fill the gaps in the staff of the department, Corner brought to Baltimore his senior colleague and close personal friend, Robert Kyle Burns, Louis B. Flexner from Weed's department at Johns Hopkins, and Samuel R. M. Reynolds from Long Island Medical College.

With this core, unfinished business from Streeter's period was continued and Corner reshaped the department toward the modern trends in experimental rather than morphological embryology, recognizing that the future basically lay in physiology, biochemistry, and biophysics.

World War II, however, interrupted peacetime activities when Corner was barely settled in. One day, early in the war, he called together the full scientific, technical, and custodial staff and told them that after much cogitation and following consultation with Carnegie Institution officers and trustees, the War Department, and various other advisors, he had been unable to find any way in which a department of embryology per se could be of service to the war effort. Therefore, the members of the department were advised to seek war work individually with the assurance that they would be welcomed back to their posts as soon as the war was over. Furthermore, during the interval, he himself would remain in Baltimore and do everything he could to keep pending research projects in "stand-by" condition, e.g., precious tissue cultures to be kept alive, equipment to be kept in operating shape, the monkey colony to be maintained, and so on. This he did in addition to responding to many calls for consultative, advisory and administrative services, and membership on wartime committees and commissions.

One staff member whose wartime job was in the Office

of Medical Information of the National Research Council in Washington remembers a long-distance telephone call from Dr. Corner on one occasion, reporting that Monkey #940 would be 103 days pregnant later that week. Should he inject it with India ink according to the standard protocol, and if so, in what fixing fluid should the removed tissues be stored? Surely a remarkable wartime service to science as well as the country!

When the war was over and "normalcy" restored, research at the Department of Embryology went into high gear. Several new members were added to the roster of returnees: Walter Wild, David Tyler, Bent Boving, Arpad Csapo, and David Bishop. Of particular advantage was the addition to the group of George W. Bartelmez, recently retired from the University of Chicago's Department of Anatomy. He brought his wide knowledge and experience as a vertebrate embryologist and, specifically, continued his study of the anatomy and physiology of the arteries of the primate uterus. He and Hartman cooperated with Corner in the latter's definitive publication on the life history of the corpus luteum in monkeys.

In addition there were numerous visiting fellows of multitudinous origin, all of whom carried back home a high opinion of the caliber of work done at the Carnegie Laboratory and of the men doing it. The famous "Carnegie Lunch Table" with its friendly erudite conversation became something of an international bond.

Corner himself had time for only a limited amount of scientific work. He had completed the corpus luteum study, as noted above, published studies of normal and incomplete twinning, and most particularly, in the years after 1949, worked with Arpad Csapo upon uterine muscle and the hormonal control of its action.

As author and editor he was enormously busy through-

out the Carnegie years. The statistics of his scientific and historical writings, publications of lectures, book reviews, obituary articles, and annual reports of the Embryological Laboratory are startling: ninety-seven principal articles in fifteen years!

In 1949 he gave the Vanuxem Lectures at Princeton, which discussed the hormones of the reproductive system in terms comprehensible to a lay audience. The lectures were published as *The Hormones in Human Reproduction*. This book appeared in translation in Spanish, Portuguese, French, Italian, and Swedish and was perhaps the most widely popular of his books. It is still available in paperback form.

The Terry Lectures given at Yale were published in 1941 as *Ourselves Unborn*. The final words of the book interestingly embody the concept which Corner initially encountered in Watson's course in psychology in his senior year in college: "We bear through all our days the marks of intimate kinship with the animal world, tempered by powers of the mind that bestow dignity and honor upon the life of the body." This book, widely and favorably reviewed, was published in Spanish translation in 1950. In that same year, the Corners translated Inés L. C. de Allende's book, *Cytology of the Human Vagina*, from Spanish into English for publication by Hoeber, New York. Both Dr. and Mrs. Corner studied Spanish to enable them to make the translation, and of course this familiarity with Spanish greatly enhanced the value and pleasure of Corner's numerous appearances as guest lecturer at South American universities and societies.

The Addison Lecture at Guy's Hospital in 1950 and the Huxley Lecture at Charing Cross Hospital in 1959 took him again to London.

Sigma Xi selected Corner as visiting lecturer for 1950. He gave the same lecture on the menstrual cycle of the Rhesus monkey twenty-one times as he visited colleges and

universities in the southeastern states. The repetitions he found far from monotonous as he was interested to see how each new place and new audience stimulated a fresh approach.

Over the years Corner was tapped to present commencement speeches at colleges and universities. Two deeply philosophical talks were so warmly received as to call for publication. *Anatomists in Search of the Soul* was published in 1919, and *A Glimpse of Imcomprehensibles*, given at Swarthmore College in 1954, was published in that year. Both of them are reproduced in *Anatomists at Large* as well as the very early paper on *Mithridatium and Theriac*, which was presented before the Johns Hopkins Medical History Club in January 1915. *Anatomist at Large* itself was published in 1958 and includes a brief autobiography up to that date, as well as the two lectures cited and several other small essays.

One book in particular required especially long and intense work, the *Autobiography of Benjamin Rush* (1745–1813), based on a manuscript of Rush's autobiography and commonplace book. Corner both edited it and supplied extensive annotations amounting to a history of Philadelphia and indeed of the young nation at that time.

A by-product of the Rush book was the suggestion that he similarly edit and interpret a newly discovered diary of William Shippen (1736–1808), first professor of anatomy and midwifery at the University of Pennsylvania. Corner himself was too busy at the time to do so, but Mrs. Corner undertook the project. She had been increasingly interested in medical history and had already used her librarian's training and her agile pen to produce some short articles on John Fothergill, a medical contemporary of Rush and Shippin. *William Shippen, Jr., Pioneer in Medical Education* was published in 1951. This was the start of Betsy Copping Corner's fine work in medical history. Unfortunately, her long ill-

ness prevented her from completing her second book based on Fothergill's correspondence. Dr. Corner did it for her, and *Chain of Friendship: Selected Letters of Dr. John Fothergill* appeared in 1971.

But what Dr. Corner designated "the minor statesmanship of science" was ever more demanding. In 1940 he was elected to both the American Philosophical Society and the National Academy of Sciences. He was vice president of the latter from 1953 to 1957. He noted that in his final year at the Carnegie Laboratory he was member or officer of nineteen committees, fifteen of them holding one-to-six meetings a year outside of Baltimore. With him, membership was never *pro forma*; he worked hard and contributed so substantially that he was constantly in demand by yet more societies.

In 1952-53 he was honored by appointment to the George Eastman's Visiting Professorship at Oxford. This entailed a rich and deeply enjoyed year's stay in Oxford, where three years previously he had received an honorary degree from the university. During the year of the professorship he was made a fellow of Balliol College with its numerous rights and privileges and interesting duties. He renewed old friendships and made new ones, and participated in the college life and in the fascinating activities and traditions of Oxford, town and university. He worked for some time in the anatomical laboratory, where he investigated the nerves innervating the uterine muscle, resulting in a paper in the *Anatomical Record*.

In the two years of his directorship of the Carnegie Laboratory that remained after his return from Oxford, Corner's lecture schedule became more and more crowded and new committees took a great deal of time.

Of one committee, that established by Vannevar Bush within the Office of Scientific Research and Development

which Bush had headed during the war, Corner was made chairman. The committee studied the development of aids to the blind. Specific results were meager, but the whole field was canvassed by a group of experts and ways for future research were set forth. A second committee was that of the Yerkes Laboratory of Primate Biology where Corner was a member of the Board of Scientific Directors for many years. His work on the Committee for Research in Problems of Sex (he succeeded Yerkes as chairman in 1947) brought him into contact with Alfred Kinsey, and an interesting involvement in some of the controversies about the Kinsey report. Next, a particularly heavy load of work was associated with one of the committees of the Guggenheim Foundation, that responsible for selection of fellows for the United States and Canada. Work on the International Nomenclature Committee took the Corners to England almost every summer, and additional occasions for this pleasant activity (both Corners being fond of travel) came when he was installed as a member of the Royal Society of London in 1955.

With the approach of his retirement from Carnegie, Corner again face the problem of "What next?" But as so often before, an attractive offer was made before the problem became acute. Detlev Bronk, president of the Rockefeller Institute for Medical Research in New York City, asked him to undertake the writing of the history of the institute. Its trustees wished to publish such a record in recognition of the fiftieth anniversary of the institute's founding, soon to be celebrated. The intrinsic interest of the assignment promptly decided Corner to accept, particularly as additional incentives were offered: space and assistants for his personal research and that of an associate he might wish to bring with him. Arpad Csapo readily accepted his role in

this scheme and the future of the ongoing investigation of uterine muscle was assured.

ROCKEFELLER

In the late summer of 1955 the Corners moved to a pleasant apartment near the Rockefeller Institute and a very agreeable interlude commenced. It was soon apparent that the time Corner spent on the Rockefeller history outstripped that devoted to the uterine studies. The latter quickly slipped into the realm of advanced modern physiology and biochemistry with which Corner felt that Csapo was better equipped to cope than he, though his advisory role was maintained with great mutual benefit.

Writing the history of the institute involved a mighty task of research into records both written and alive. The files of the institute were a vast treasure trove in which Corner, with his experience of academic institutions and his sympathetic interest in human beings, was able to find material for a fascinating story far removed from standard, dry-as-dust histories of organizations. As for the living portion of the archives, fifty years is not so long a time but that many of the performers on the Rockefeller's distinguished stage were still alive and well, and in other cases relatives and knowledgeable friends were available for interviews. It was a very different sort of medical history research from the study of Salernitan surgery in the twelfth century that he made in 1937. The Rockefeller history called for mature judgment and in many instances supreme tact. But the famous people, many of them household names, come alive on Corner's pages, complete with ambitions, frustrations, intrigues, and instances of heroic unselfishness, good nature, and personal charm.

It took far longer to write than originally projected, in

fact a full five years rather than two. When complete the Rockefeller Institute had a fine account of its early years to which Bronk added a foreword with glowing praise of its author.

The years in New York and the many trips in the United States and abroad formed an active background to the historical work. The travels included lecture tours, society meetings, and trips to institutions that were bestowing honors and degrees upon him (a grand total of ten of the latter: seven in the United States, and three foreign).

Again in 1960 a decision as to future course had to be made, but there was no interval, for "a job came looking for me." Henry Allen Moe, newly elected president of the American Philosophical Society, offered him the post of executive officer of the society.

AMERICAN PHILOSOPHICAL SOCIETY

It was an ideal post for Corner. He had an intimate acquaintance with historical Philadelphia through the work on Benjamin Rush's autobiography. The Philosophical Society itself was founded in that time and Rush was its vice president from 1797 to 1801. Knowledge of the work of the society continuously to the present day kept Corner in touch with the scientific and cultural life of the parent city, and his own participation as a member of the society since 1940 gave him current insight. He found Philadelphia a pleasant place to live and was happy in a large circle of scientific and history-oriented friends.

His duties at the society were not too demanding but were varied, interesting, and responsible: daily business and correspondence, preparing the annual budget and overseeing expenditures, editing the society's publications, chairing the committee directing grants, and other in-house committees, plus close association with the librarian and his

work. Corner's time at the society bridged the terms of four presidents and in the course of that interval his activities constantly widened, including such things as envisaging, instituting, and managing the society's musical evening, of which he said, "I was something of an impressario!" He had contact with a passing parade of prominent people (including three U.S. Presidents), as well as the wide range of the society's own membership.

In persuading Corner to accept the post, Moe had assured him that he would have ample time for writing. As his duties increased those precious times shrank, but still the Philadelphia "Age" was highly productive. In addition to the array of smaller pieces, four major works emerged.

First, *George Whipple and His Friends: The Life Story of a Nobel Prize Pathologist*, commissioned by the Rochester Medical Alumni. This was a real labor of love, for Corner's friendship and admiration for Whipple dated back to his medical school days, then to the stirring times in the founding of the Rochester Medical School. The association had continued ever since. Writing the book was particularly pleasant because Whipple himself participated in it. Retired after thirty-one years at Rochester, he was available for consultation and to read and approve the manuscript.

A second agreeable commission was the writing of the history of the Medical School of the University of Pennsylvania. Titled *Two Centuries of Medical Education*, it appeared in 1965 in time for the 200th anniversary of the school's founding. Again Corner's acquaintance with the subject, from the work on Benjamin Rush, made the task appropriate and enjoyable.

The third book written in Corner's Philadelphia period, *Doctor Kane of the Arctic Seas*, gave him particular personal satisfaction, for it tied together several strands of his own life's history and abiding interests. First, perhaps, the re-

membered tales of his seafaring “Grandpap” Evans. Then, his own recollections of boyhood haunting of the docks at the foot of Broadway in East Baltimore, a few blocks from his own home—great seagoing cargo vessels lay in Baltimore’s inner harbor in those days, fraught with a boy’s vision of voyages and adventures. And even before he could read, there was the marvelous volume of *Kane’s Arctic Adventures in the Years 1853, 54, 55* in Grandfather Corner’s library. Initially the wonderful pictures alone drew him on, then when he could read and reread them, the stirring accounts of the adventures of his hero lost in Arctic ice. There was even a mercantile connection between Kane and Corner’s own grandfather Evans, the pioneer in the food-packing industry, who provided supplies for some of the great Kane expeditions.

Corner’s summers with the Grenfell Mission in Labrador were another closely related and vividly remembered strand in the tapestry, and through the years he collected Kane memorabilia, contacted Kane survivors who supplied family papers, and visited every available Arctic collection and research institute.

Even when not connected with the Kane story, Corner’s unwavering love of the sea was a strand. He always traveled by ship when possible and, especially charmingly, in 1972 took his two grandsons with him when he attended an international congress of medical historians in London, crossing the Atlantic on the *Queen Elizabeth II*, just so that they could have the experience of a voyage on one of the fast disappearing great ocean liners. Thus, writing his fourteenth book on *Doctor Kane of the Arctic Seas*, in 1972, was the gratifying fulfillment of a long-held resolve.

But it was not his last book. In 1981, his fifteenth book and masterful autobiography, *The Seven Ages of a Medical Scientist*, appeared, happily in time for him to see it in the

final months of the remarkable life it records. All the reviewers of the book commented on the delightful literary style, upon the value to the history of twentieth century science of the recollections of his own research career, and of the activities of all the contemporary greats whom he knew personally. The reviewers cited his titles "Discoverer of Progesterone" and "Father of the Pill" among the others. All are impressive titles but cold, whereas *The Seven Ages* is the unstudied revelation of a wise, witty, sympathetic personality.

In 1977 Corner felt that it was time for him to assume elder statesman status and with the assistance of his warm friend, Jonathan Rhoads, then president of the American Philosophical Society, it was arranged that Whitfield Bell, the society's librarian, should take Corner's place as executive officer while still continuing as librarian. To lighten Bell's executive duties in this dual post Corner retained his work as editor of the society's publications and his chairmanship of the Committee on Research. Life under these new arrangements—he described this era as "Retired but not Retiring" in his characterization of his Seventh Age—was kept from loneliness by the continuing work at the Philosophical Society plus the companionship of many friends there and at the Wistar Association. Old friends at a distance were brought near by extensive correspondence, which included the Belts in Los Angeles, the Richters in Baltimore, Csapo in St. Louis, Booth in London, Weddell in Oxford, and Inés de Allende in Córdoba. Close at hand younger friends in Philadelphia, such as Jonathan Rhoads and the Richardsons, were supports and pleasures and kept him *au courant* with scientific and cultural affairs. His relatives of several generations, living both nearby and far away, were affectionately attentive.

Corner was fortunate in having a sound constitution and basically good health to support his boundless energy and

activity. Only a severe impairment of his vision in later years was a problem.

In his private life he experienced both personal satisfaction and two serious bereavements. He wrote movingly in his autobiography of his happy married life and of his pleasure in his wife's growing interest in medical history. Her prolonged terminal illness was a grievous and tragic experience. Dr. Corner was devoted to his two children, and the sudden death of his daughter Hester Ann from acute myelogenous leukemia just before she was to receive her Ph.D. in classics at Yale was a cruel blow. He was very proud of his obstetrician-gynecologist son, the fourth George Washington Corner, who happily survives. George IV's work on the placenta with E. M. Ramsey, mirroring Dr. Corner's own interest in reproductive anatomy and physiology, gave him much pleasure. His son's wife and the grandchildren were an abiding joy to Corner, and he spent the last year of his life with them in Huntsville, Alabama.

Dr. Corner himself provided a fitting conclusion to this present biographical memoir, which is in fact as much the memoir of a great man as of a great scientist. The final paragraph of *The Seven Ages* reads:

I once had a correspondent who held that the universe is no good and should not exist. I disagree with him. I think highly of the universe. The buffets it gives us, we must take as they come; the benefits we can often help to arrange. I am proud to have been a member of the universe these ninety years past. One accepts, of course, the regulations for enrollment, pays his annual assessment of hard work, and aims to be a useful citizen of the local galaxy. In return, he receives the friendship of other members and the love of those near and dear to him.

NOTE

1. In all mammals the eggs develop in small chambers in the substance of the ovary, the follicles. These are lined by follicular or

granulosa cells which secrete the hormone estrogen. The wall of the follicle is composed of fibrous tissue, the theca. When the egg is ripe the follicle ruptures, ovulation, discharging the egg into the Fallopian tube or oviduct, which it traverses into the uterus. There it implants on the mucous membrane lining that organ, the endometrium. After ovulation the granulosa cells are transformed into lutein cells forming the corpus luteum. These cells secrete the hormone progesterone.

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