

NATIONAL ACADEMY OF SCIENCES

JOHN HEYSHAM GIBBON, JR.

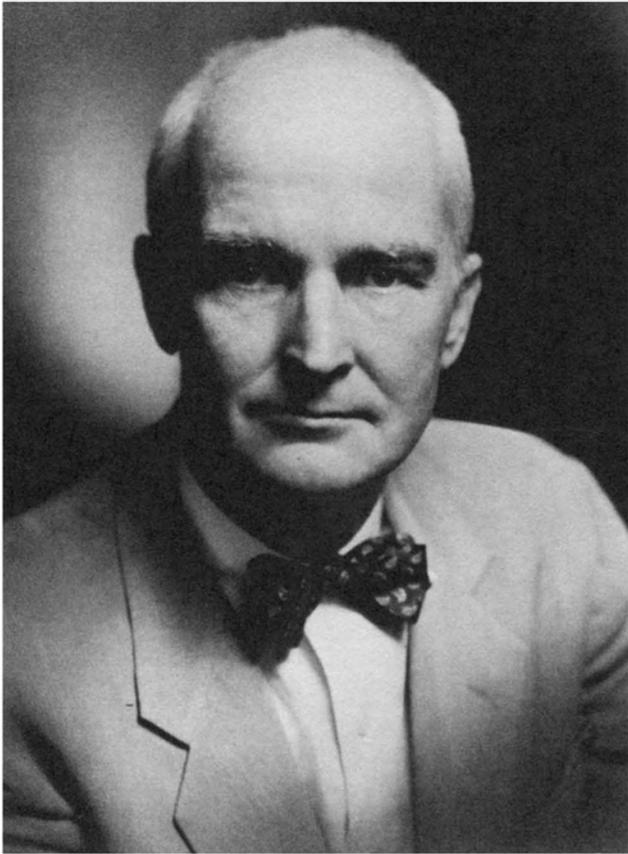
1903—1973

A Biographical Memoir by
HARRIS B. SHUMACKER, JR.

*Any opinions expressed in this memoir are those of the author(s)
and do not necessarily reflect the views of the
National Academy of Sciences.*

Biographical Memoir

COPYRIGHT 1982
NATIONAL ACADEMY OF SCIENCES
WASHINGTON D.C.



Photograph courtesy of Fabian Bachrach.

John H. Gibson Jr.

JOHN HEYSHAM GIBBON, JR.

September 29, 1903 – February 5, 1973

BY HARRIS B SHUMACKER, JR.

JOHN HEYSHAM GIBBON, JR., or Jack, as he was generally known, was born in Philadelphia, Pennsylvania on September 29, 1903. His mother was Mrs. Marjorie Young Gibbon and his father John Heysham Gibbon, a distinguished, nationally recognized surgeon and professor of surgery at the Jefferson Medical College. His family background is of unusual interest and was undoubtedly of considerable importance in his career.

The first of the Gibbons arrived in Philadelphia from Wiltshire, England in 1684 and, as Jack's sister Marjorie* says, were named prophetically John and Margery. Jack's great-great-grandfather, John Hannum Gibbons, born in Chester County, Pennsylvania and educated in medicine in Edinburgh, was the first American doctor in the direct line of five down to Jack. His son, the first John Heysham Gibbon, born in 1795, dropped the *s*, and the name remained Gibbon thereafter. Though he graduated in medicine from the University of Pennsylvania, he never practiced; instead he became a prominent mineralogist and in 1834 was appointed assayer of the U.S. Mint at Charlotte, North Carolina. His

* All quotations except those cited specifically as from other sources are from a carefully prepared, delightful family history written for me by Marjorie Battles during the winter of 1979.

second son, Robert, became a practicing physician, as did Robert's two sons, Jack's father and uncle. In addition, through Dr. Gibbon, Sr.'s grandmother, Jack had a great-great-great-grandfather who was also a doctor, John Lardner, "Physician of London." A nephew still carries the Gibbon name on in the profession. The family can be proud, indeed, of the heritage of medical service that reached such heights in the accomplishments of John H. Gibbon, Jr.

The only grandparent alive during Jack's life was his maternal grandfather, Samuel B. M. Young, one of our truly outstanding military figures. Born of a prominent Pittsburgh family in 1840, he volunteered upon the outbreak of the Civil War. His promotions from the time of his enlistment in April 1861, from private through the ranks to brigadier general, came about with unbelievable rapidity, within a period of only four years. Following service in Cuba during the war with Spain, he was made a major general and later a lieutenant general. Perhaps the most important post he held was that of the first presidency of the War College in 1902. At the time of his retirement, the Secretary of War, Elihu Root, stated: "There can be no better wish for the Army in the future than that its officers shall remember how distinction and the highest rank have come to this officer, not as a result of self-seeking or political or social influence, but as the result of duty well done."*

This unusual standard of military achievement was upheld by General Young's son, John, and his grandson, Jack, and the lifetime achievements of both, like his, resulted from their own efforts and not from "influence." Jack's father served both in the Spanish-American War and in World War I, during which his assignments included those of consultant in surgery to the American Expeditionary Forces and, ul-

**New York Herald Tribune*, 2 Sept. 1924.

timately, surgical consultant to the American hospitals in England.

Early during World War II, Jack, too, volunteered for military duty, thus interrupting his practice, teaching, and, of even more significance, his research activities. Invalided home with a herniated disc after he served with distinction in the Pacific with the Pennsylvania Hospital Unit, he took over direction of the surgical service at the Mayo General Hospital in 1945, a post he kept until his discharge at the end of that year.

Jack's father, John Gibbon, Sr., was born in Charlotte, North Carolina in 1871. Following his education in preparatory schools, he attended the Jefferson Medical College, from which he graduated in 1891. He remained closely associated with this institution as well as with the Pennsylvania Hospital through his active years. He was a devoted teacher; a kindly, sympathetic practitioner; and a gentle, careful, skillful operator. He contributed significantly to the clinical surgical literature but, unlike his son, he did no experimental laboratory research. He was honored by being made an officer of a number of professional societies and became first secretary and then president of the American Surgical Association.

In 1901 in San Francisco he married Miss Marjorie Young, whom he had met during the Spanish War at Jefferson Barracks, Missouri. She was one of the "five beautiful Young sisters," daughters of General Young and his wife, Margaret McFadden Young. The new Mrs. Gibbon had been educated in various places according to the location of her father's military assignments. She had a deep love of books and poetry and never stopped reading. It is probable that Jack inherited his fondness for poetry from her. Her experiences were broadened by a year abroad when, following the death of her mother and the marriage of her three older sisters at the turn of the century, she took her ten-year-old

sister to Dresden for a year of study. Full of wit, affection, and cordiality, she made for herself a warm and stimulating place among the family's Philadelphia friends, though she often told her children amusing tales of what some of the local people had expected of the "Western Bride."

Jack and his brothers and sister grew up in a happy household, living in Philadelphia during the winter and in summer near Media on beautiful Lynfield Farm, which Jack was to inherit upon his parents' death. It must have been a busy home, with many visitors who often stayed weeks at a time, including "army cousins fattening for West Point, southern cousins coming up for their Philadelphia dental appointments, a White Russian refugee, and a homesick Louisiana bride whom mother had met on a commuter train."

Jack was eighteen months younger than Marjorie, eighteen months older than Sam, and four and a half years older than Robert. He was athletic, very competitive, and at times exhibited an "explosive temper." Excelling his brothers and friends in almost all sports, he was finally overtaken by them in horsemanship. One of the favorite pastimes of the family was chess, a game often begun before dinner, continued between courses, and usually terminated with Jack the winner. This game was one for which his love was never lost. He had great affection and admiration for his parents and enjoyed long talks with his father, whose devotion to his profession and receptiveness to new ideas Jack valued highly. Their major differences lay in the field of politics, his liberalism standing far apart from his father's conservatism. Both parents died in 1956 within a week of one another.

Jack attended the Penn Charter School in Philadelphia, where he was an excellent student. Marjorie says that he returned from summer camp in 1919, just before entering Princeton, an entirely changed person, in large measure because of one of his counselors, Jim Landis, who was later to become the first chairman of SEC. Though he had always

been studious, he was now literally "afire" with intellectual interests, keen about literature and philosophy. At the end of his sophomore year, he joined Marjorie, who was taking courses at the Sorbonne, for a summer in Europe. They wandered about free and unrestrained, Jack going along with her "gung-ho" interest in French history, but spending all his spare time reading William James's *Varieties of Religious Experience*. He talked of going to medical school in Edinburgh and of her keeping house there for the two of them. Instead, he returned to Princeton. These first years at Princeton were not entirely happy ones, since he felt too young and immature for real companionship with his classmates, having entered before his sixteenth birthday. A great deal of his time was spent reading and studying. He graduated in 1923 at nineteen.

Towards the end of his first year in the Jefferson Medical College, Jack considered quitting, thinking that something else, perhaps writing, might prove more to his taste. His father made a very strong case for the continuation of his professional education, telling him, "If you don't want to practice you needn't, but you won't write worse for having it." He received his medical degree in 1927.

Though Jack has said and written that his interest in research was stimulated during his internship at the Pennsylvania Hospital, Marjorie feels that the investigative scientific spirit may have been with him since early childhood. As an example, according to one of their mother's stories, she was walking down the street one day holding his little hand when she found that her progress was slowed by his pausing to wave his foot over the curb. She asked, "Jack, what *are* you doing?" He answered: "Well, Mother, if God is everywhere and you can't see Him and you can't hear Him, why can't you feel Him?"

His interest in medical experimentation, however, was first aroused by Dr. Joseph Hayman's clinical studies. Dr. Hayman was looking into the effects of potassium chloride

versus sodium chloride in the diet of a severe hypertensive; the patient was unaware of which of the two salts he was served. While taking blood pressures at intervals, Jack came to the exciting realization that contributions of new knowledge could be forthcoming from controlled experimentation.

It is interesting that his initial stimulus came from a physician, in view of the hopes of surgeons that their specialty should be comprised of good physicians who have as their primary therapeutic modality the special capability of operating. This objective certainly underlay Jack Gibbon's professional life. Similarly, the obvious conviction that the best management of surgical disorders requires good basic scientific understanding of them makes his early and continuing interest in physiological and biochemical matters of real significance. It is probably meaningful that during the period from 1930 to 1933, only one of his nine publications appeared in a surgical periodical; the remainder were published in such journals as the *American Journal of Medical Science*, the *Journal of Clinical Investigation*, the *Proceedings of the Society of Experimental Biology and Medicine*, and the *Archives of Internal Medicine*.

He consulted his father's partner, John B. Flick, surgeon of the Pennsylvania Hospital, concerning the possibility of a career that would ultimately combine research and surgery. John Flick not only assured him that the two were perfectly compatible, but made the fortunate suggestion that he apply for a research fellowship with Dr. Edward B. Churchill at the Harvard Medical School. Jack realized that this would permit him both to find out whether he had any capability for research and whether he liked it. His father offered no objections, provided he continue to recognize the value of balancing research with surgical experience.

He received the appointment and began working with Churchill in February of 1930 in a small laboratory in the

Gate House of the Boston City Hospital. His preceptor suggested that his first research effort be a study of the relationship between pulmonary artery pressure and blood flow in experimentally produced pulmonary arteriovenous fistulas. Stimulated by this project, he proceeded to undertake a number of other investigations that dealt with pulmonary circulation and cardiac function.

A few months after his arrival in Boston, Churchill succeeded to the codirectorship of the West Surgical Service at the Massachusetts General Hospital and moved the laboratory to the top floor of the Bullfinch Building. It was in this institution in February of 1931 that Jack first conceived the idea of developing a mechanism for achieving extracorporeal gaseous exchange and temporarily maintaining body circulation. A patient had developed massive pulmonary embolism following a cholecystectomy. She was taken to the operating room for observation, and Gibbon was assigned the duty of following vital signs. He was to notify his chief when her condition deteriorated to the point where it was felt justifiable to undertake pulmonary embolectomy—an exceedingly risky procedure at that time. This took place early the next morning and, despite Churchill's well-performed operation, ended fatally.

Jack described the development of the idea thus:

During that long night, helplessly watching the patient struggle for life as her blood became darker and her veins more distended, the idea naturally occurred to me that if it were possible to remove continuously some of the blue blood from the patient's swollen veins, put oxygen into that blood and allow carbon dioxide to escape from it, and then to inject continuously the now-red blood back into the patient's arteries, we might have saved her life. We would have bypassed the obstructing embolus and performed part of the work of the patient's heart and lungs outside the body.*

*J. H. Gibbon, Jr., "The Development of the Heart-Lung Apparatus," *Review of Surgery*, 27 (1970):231-44.

The conception of what was to prove his life's principal work was only one of two important events of that year in Boston. The other was his marriage to his constant helper in the laboratory, Churchill's technician Mary Hopkinson, affectionately known as Maly, daughter of Charles Hopkinson, one of America's greatest portraitists. It is an extraordinary coincidence that both Jack and his father should have married one of five sisters.

In the spring of 1931 the couple returned to Philadelphia. During the next three and a half years, the mornings were spent practicing surgery and the afternoons working upon a variety of research problems in the laboratories of the University of Pennsylvania's School of Medicine. This period confirmed John Flick's early judgment that it was feasible to combine clinical surgery with research. Though unable to pursue the idea that had captivated his imagination in Boston, Jack was fortunate in many ways. Of particular value were his research opportunities and close association with Eugene M. Landis, who later became professor of physiology at Harvard. A number of important contributions were forthcoming, many carried out conjointly with his wife.

The idea of developing an apparatus for cardiopulmonary bypass remained continuously and vividly in the back of his mind. When he asked Churchill for another year's opportunity to work with him, he was not only awarded a fellowship, but was told that Maly might have a position as his technical assistant. The research plan he had in mind did not by any means meet with universal approval. As a matter of fact, Churchill himself was not enthusiastic though he did not object to its being undertaken. Others, thinking more of his potential academic career, advised him to embark upon less ambitious projects and ones more likely to result in publications in the medical literature. An exception was his friend Eugene Landis, who was particularly helpful and judged that

the effort was worth the attempt and might, indeed, prove successful.

The work was begun and the husband-wife team had a very rewarding year. During the experiments the blood had to be rendered noncoagulable and heparin was available as a suitable agent. The lack of a heparin antagonist at that time did not prove a serious handicap. The initial arterial inflow was through the femoral artery and the venous outflow from a superior vena caval catheter introduced through a jugular vein. Exclusion of cardiac function was achieved by pulmonary artery occlusion. The first oxygenator was a revolving cylinder into which the blood withdrawn from the animal was introduced tangentially at the top in the direction of rotation and resulted in a film of blood descending down the inner surface of the nonwetable metal cylinder. It was collected at the bottom through a knife-like edge into a stationary cup that was made of glass and surrounded by a jacket through which warm water could be circulated to avoid chilling the animal. A similar water jacket was utilized in another portion of the circuit and the blood was returned to the animal. The film of blood was exposed to oxygen and it was determined that it took up oxygen and lost carbon dioxide satisfactorily. After a while, to their excitement and joy, it proved possible to sustain the entire cardiorespiratory function of cats for nearly four hours and to demonstrate that the animals could, after the extracorporeal device was discontinued, maintain their own cardiac and pulmonary activity. These results were not reported until 1937.

After the year in Boston the Gibbons returned to Philadelphia in 1935, and the work was continued in the Harrison Research Laboratories of the University of Pennsylvania. Progressively more refined apparatus was developed, and the experiments went better and better, until by 1939 it was possible to report that, after periods varying from twelve to

twenty minutes of total substitution of the device for the function of the heart and lungs, four cats had survived indefinitely in healthy condition, and others for varying shorter periods of time.

Though the initial effort had been undertaken with the hope of managing massive pulmonary embolism better, Jack perceived shortly after it was begun that it had far greater potentialities. At the time of his report of these studies to the 1939 meeting of the American Association for Thoracic Surgery, he stated modestly: "It is conceivable that a diseased mitral valve might be exposed to surgical approach under direct vision and that the fields of cardiac and thoracic surgery might be broadened."* The presentation was discussed by the guest speaker, Professor Clarence Crafoord of Stockholm, and by Leo Eloesser, who had been president of the organization the preceding year. Eloesser said that the report reminded him of the fantastic tales of Jules Verne, which anticipated seemingly impossible accomplishments that were later realized.†

During the next few years, further innovations in the device were made with the idea of supplanting the function of the heart and lungs of larger animals and, eventually, of patients. It was at this time that the investigations had to be stopped because of World War II.

Upon Jack's return to Philadelphia after his military service, he was given an appointment as assistant professor of surgery at Pennsylvania; shortly thereafter, early in 1946, he became director of surgical research at the Jefferson Medical

*J. H. Gibbon, Jr., "The Maintenance of Life During Experimental Occlusion of the Pulmonary Artery Followed by Survival," *Surgery, Gynecology, and Obstetrics*, 69 (1939): 602-14.

† Unfortunately, having forgotten momentarily about the rules of the Society, Jack had already submitted the paper to *Surgery, Gynecology, and Obstetrics* so that it could not appear in the *Journal of Thoracic Surgery*, and the discussions of Crafoord and Eloesser did not accompany the publication.

College. Here was the opportunity he needed. Adequate research laboratories soon became available, well-equipped with the necessary apparatus and facilities for the best possible care of experimental animals. A staff of eager and hard-working young associates joined him. The work on the heart-lung machine was resumed and progressed more rapidly with the generous assistance of the International Business Machines Corporation and its board chairman, Mr. Thomas J. Watson.

In 1956 Jack received the prized Samuel D. Gross Professorship of Surgery and chairmanship of the Department, posts he held with great distinction until his voluntary retirement in 1967. Under his leadership the Surgical Department at Jefferson became truly outstanding. It was soon the Mecca for intelligent, inquisitive, innovative young surgeons from home and abroad. The residency training program was excellent. Students and house staff were impressed with his gentlemanly straightforward manner, his great ability, and his insistence that thinking fruitfully was even more important than learning factual information. Under his inspiring guidance, all about him wanted to make the most of their capabilities. He was greatly admired for his clarity of thought, careful analysis, sound conclusions and judgments, and open-minded receptiveness.

Though the development of the heart-lung machine constituted his long-term primary interest and was his greatest scientific contribution, he and his colleagues worked upon a variety of other experimental laboratory and clinical problems, and his list of publications is truly a significant one. It includes basic physiological and biochemical studies that assisted considerably in better understanding of cardiac function, pulmonary ventilation, acid-base balance, anesthesia in thoracic procedures, carcinoma of the lung, and other esophageal and pulmonary problems. In addition, not included in

his list of published works were numerous valuable discussions of papers presented at meetings of various surgical societies—understanding, pertinent remarks that added to the full appreciation of the potentialities and limitations of the material presented.

Progress in the development of the heart-lung machine was often slow but always steady, and after a period of years it resulted in a highly refined and efficient apparatus. The final model utilized a stationary screen oxygenator. This tedious but rewarding work reached its culmination on 6 May 1953, when Jack was able to perform the first successful open heart procedure upon a patient with the aid of total cardiopulmonary bypass. With the help of his wife and associates, he had by then pursued the investigation from its conception, through its period of gestation and infantile progress, into adult maturity. It was characteristic of him to pass on happily to younger surgeons in clinics about the world the opportunity his contribution provided for developing almost limitless new techniques that have made possible the repair of most of the congenital and acquired cardiac abnormalities. It was also in character that he should have welcomed the various modifications, soon forthcoming, of his extracorporeal device.

Though the principal benefit of the apparatus for extracorporeal circulation and respiration was its unbelievably great extension of our capabilities to deal with hitherto incurable cardiac lesions, it is quite evident that it has had an enormous influence over and beyond these therapeutic advances. Each step forward always has a potential benefit that is more widespread than the contribution itself. It would seem safe to say that none has had a more far-reaching, helpful effect upon medicine, its specialties, and the basic sciences than Gibbon's. The surgical progress that resulted from use of the heart-lung machine has brought about in surgery a renewed emphasis upon the importance of precise

anatomic and physiologic diagnosis prior to operation. It has made it increasingly evident that the proper care of patients is a matter of carefully planned teamwork, rather than the responsibility of a single individual. Perhaps more than any other single innovation, it has made surgeons aware of the importance of the many associated physiopathological problems that accompany the disorders they treat. It has certainly been one of the stimulating influences for the study of the total circulation and its component parts, the distribution of blood flow under varying circumstances, the perfusion of organs and tissues, the factors that are related to metabolic and respiratory acidosis, ventricular function, bleeding and clotting abnormalities, disturbances of water and electrolyte balance, and renal function. It has played an important role in instigating further efforts to understand the effects of body and cardiac hypothermia, arrhythmias of the heart, and new and better ways of bringing about cardiac resuscitation, of dealing with heart block and other arrhythmias, and of supporting the inadequately functioning ventricle. Almost certainly nothing has proven a stronger incentive for the establishment of first-rate specialized recovery rooms and intensive care units. It has provided a real stimulus for the development and improvement of helpful monitoring devices. It has underlined the necessity for surgeons to be well grounded in general medicine and in the basic fundamentals and has, furthermore, emphasized in a most convincing way the importance of accurate, gentle, precise, expeditiously performed operative work.

At the same time, the development and utilization of the heart-lung apparatus and the concomitant ever-broadening field of effective cardiac surgery have served as a challenge to adult and pediatric cardiologists and radiologists to make as specific and meaningful diagnoses as possible, based upon careful physiologic and anatomic assessments—and they

have come up with assessments hardly dreamed possible only a decade or so earlier.

Over and beyond these influences, the cardiac operations dependent upon the utilization of extracorporeal circulation have played their part in improving doctor-patient relationships, very likely because human beings have a particularly great reverence for their hearts. They have helped physicians and surgeons to become closer to their patients, more aware of their responsibilities to them and their families, and more appreciative of the stresses, hopes, and disappointments that accompany disease and malformation. They have been of considerable influence in making obvious the necessity for the patient and his family to understand the nature of his difficulty, what can be expected of the proposed operation, the risks involved, the reasons why the determination to operate was made, and the alternatives if any exist. They have brought about more sympathetic and intelligent relationships between the profession and those who need professional help.

The laboratory and clinical success with the apparatus for cardiopulmonary bypass did not lessen Jack Gibbon's experimental, clinical, and teaching interests. At the same time, he busied himself with a thousand and one other matters. He was always concerned about political events and movements and never hesitated to express his views bearing upon them or to participate actively when he could support them. He served loyally with all kinds of local, national, and international professional organizations: the Board of Health of the City of Philadelphia, the Surgery Study Section of the United States Public Health Service, the Subcommittee of the Cardiovascular System of the National Research Council, the Committee of the International Exchange of Persons, the Subcommittee on the Cardiovascular System of the American Heart Association, and the Board of Scientific Counselors of

the National Heart Institute. He served on the American Board of Surgery and as its vice-chairman. He was on the Conference Committee on Graduate Training in Surgery and chairman of that important group. For years he was active on the Editorial and Advisory Board of the *Annals of Surgery* and its chairman from 1947 to 1957. He belonged to numerous professional organizations and was recognized by election to many important posts.

In addition to various other officerships, he became president of the Laennec Society of Philadelphia, the Pennsylvania Association of Thoracic Surgery, the Philadelphia Academy of Surgery, the College of Physicians of Philadelphia, the Society for Vascular Surgery, and the American Association for Thoracic Surgery. Of especial interest is the fact that no other father and son have been elected to the presidency of the American Surgical Association—an honor widely viewed as the highest which can be awarded an American surgeon. He was on the Board of Governors of the American College of Surgeons for a period of fourteen years and on the Executive Committee of its Program Committee, as well as the Graduate Training Committee. He became a member of the American Academy of Arts and Sciences and, last but not least, of the National Academy of Sciences. He was made an honorary member of the Society of Thoracic Surgery of Great Britain and Ireland and an honorary fellow of the Royal College of Surgeons of England.

Honorary degrees came to him from the University of Buffalo, Princeton University, the University of Pennsylvania, Dickinson College, Jefferson Medical College, and Duke University. He was a visiting professor in a number of universities and delivered many named lectureships. It was natural and deserving that he should have received many honors. Among them were: the John Scott Award of the Board of Directors of City Trusts of Philadelphia; the

Charles Mickle Fellowship of the University of Toronto; the Clarence E. Shaffrey, S. J. Medal of the St. Joseph's College Medical Alumni; the Rudolph Matas Award in Vascular Surgery of Tulane University; the Distinguished Service Award of the Pennsylvania Medical Society; the Strittmatter Award of the Philadelphia County Medical Society; the Philadelphia Award; the Dixon Prize in Medicine of the University of Pennsylvania; and the Gairdner Foundation International Award of the University of Toronto. A special annual lectureship in his name was created by the American College of Surgeons.

He retired from the Chair of Surgery in 1967 and spent the remaining years of his life happily on his beautiful farm near Media where, surrounded by family and friends, he played tennis, swam, and worked in the garden. Reading remained a constant habit. Books, periodicals, and pamphlets were his constant companions—light, heavy, amusing, stimulating, thought-provoking—all sorts. His long-standing passion for portrait painting grew and matured; he devoted progressively more time to his studio with steadily increasing success. Indeed, his work became good enough to prompt a number of commissions. Meanwhile, he traveled extensively, continued to maintain an active part and interest in surgical and educational matters, and remained involved in community and governmental affairs.

It was most appropriate that in 1963, on the tenth anniversary of the first successful open cardiac procedure performed with the aid of the total cardiopulmonary bypass apparatus that he had developed, his portrait, painted by Gardiner Cox, was presented to Jefferson Medical College. It was a happy affair, beginning at home in the rose garden. The presentation itself was made in one of the school's amphitheaters in the presence of his patient, Cecilia Bavolek, then a healthy young lady completely cured of her congenital

malformation of the heart, an atrial septal defect, which had made her so seriously ill prior to its repair ten years earlier. It is of interest that when his portrait was hung in McClellan Hall, there were only two portraits of fathers and sons who had been distinguished professors at Jefferson: Samuel D. Gross and his son, and Jack Gibbon and his father.

Almost precisely ten years later, a second portrait was presented during a memorial celebration held at the College of Physicians of Philadelphia, the oldest medical organization in the country, in his honor and in tribute to his life's work. He had died suddenly on February 5, 1973, as he would have wished, while playing a good game of tennis. This affair was held one day before the twentieth anniversary of the operation upon Cecilia Bavolek. This painting was by his father-in-law, Mr. Hopkinson, and the offering remarks were made by Maly, who had donated it. Following an afternoon scientific program, cocktails and dinner, and the bestowal of the portrait, remarks concerning what Jack Gibbon had meant to them were made by three of his close friends and colleagues. One was Clarence Dennis, an early worker in the field of mechanical heart-lung devices, another was Jack's long-time intimate companion, Professor Clarence Crafoord, head of the Thoracic Surgical Service at the Karolinska. It does not seem inappropriate that I close the life story of this extraordinary man by repeating in a slightly different manner the few remarks I was privileged to make on that occasion, since I believe that they represent what his worldwide friends felt about him and what untold thousands of others would have thought of him had they had the privilege of knowing him as well as we.

In essence this is what was said:

It is difficult to put in words what Jack Gibbon meant to us when he meant so very much. He was an inspiration to us

all because of the meaningful, innovative contributions he made to the progress of medicine and we are thoroughly persuaded that the most significant of them, the development of the heart-lung machine, will remain forever one of the true milestones in medicine. Rarely, if ever, has one single research effort expanded so much the capacity of surgeons to be of help to the congenitally malformed and to those disabled by acquired lesions.

We think of him as a professor who used his great name and his important position, not for personal gain, but as an opportunity to develop a department that was an intimate, effective teaching unit, one that provided the best of patient care, maintained an overall flavor of original investigation, and attracted young men from here and abroad. He always kept in mind his conviction that research is not only important because of its potential for contributing new knowledge, but also because it creates the ideal atmosphere in which students and young surgeons may mature to their best advantage. The bright young surgeons in this country never had a better friend. He delighted in discovering them and in helping them move ahead.

We remember him as a soldier who made the long journey home from the Southwest Pacific on a stretcher, uncomplaining, and the stimulation he brought to the Mayo General Hospital as chief of the Surgical Service.

We preserve him in our memories as a sympathetic, understanding father and adoring husband who always wanted his wife to occupy the center spot, who was most proud of her early and long-continued collaboration in the heart-lung project, whose relationship with her reflected the admiration, companionship, and deep love he felt for her.

We cannot forget him as a genial host. We see him with attractive and devoted friends at the cocktail hour and dinner, on the tennis court, by the pool, at sheep-dipping

time, in long, stimulating conversations, always warm and intimate. We think of him as a friend, the best friend one could ever wish for. We look upon him as a person with a boyish red face and twinkling, vibrant eyes that forever seemed to register a bit of amazement that he should be surrounded by so much that was good, that he had been able to accomplish so much, that so many splendid honors had come his way. We remember him as a man who, despite the seriousness of his work and play, seemed to bubble over with the excitement that characterizes the young at heart. We think of him as a liberal, feeling person who concerned himself deeply with causes and movements he felt were just.

Some men are crushed by the mantle of greatness. Some find it so heavy they must stand tall, erect, arrogant. Jack wore his with easy grace, with no undue pride, but rather with pleasant, somewhat surprised satisfaction. He will always be missed, and remembered, not with sorrow but with joy.

He is survived by his wife, Maly; one son, John; three daughters, Mary, Alice and Marjorie; his sister, Marjorie Battles; and his brother, Samuel.

The National Academy of Sciences did great honor to John H. Gibbon, Jr., by making him a member and, at the same time, did itself honor by having within its midst one of the truly great surgeons of all times.

I COULD NOT HAVE WRITTEN this volume had I not enjoyed for many years an exceedingly close, warm friendship with Jack Gibbon and his wife, Maly—one filled with memorable days of pleasant companionship and hours of unrestrained, stimulating conversation about a thousand and one things of mutual interest. Maly has turned over to me all pertinent material in her possession, such as Jack's last updated curriculum vitae. I am deeply indebted to his sister, Marjorie Battles, who has talked with me, written to me, located various mementos such as newspaper clippings, obituaries, their uncle Robert Gibbon's childhood memories of his mother,

and who wrote for my use a most intriguing history of the family with special reference to grandparents, parents, and Jack as a child, an older boy, and an adult. Finally, I wish to thank my wife, Myrtie, affectionately, for her untiring and helpful advice during the preparation of the manuscript.

HONORS AND DISTINCTIONS

DEGREES

- 1923 A.B., Princeton University
 1927 M.D., Jefferson Medical College

HONORARY DEGREES

- 1959 Sc.D., University of Buffalo
 1961 Sc.D., Princeton University
 1965 Sc.D., University of Pennsylvania
 1967 Sc.D., Dickinson College
 1969 LL.D., Jefferson Medical College
 1970 Sc.D., Duke University

MILITARY SERVICE

- 1942-1944 Major, M.C., A.U.S.
 1945 Lieutenant Colonel, A.U.S.
 1945 Mayo General Hospital, Chief of Surgical Service

HOSPITAL AND UNIVERSITY APPOINTMENTS

- 1927-1929 Intern, Pennsylvania Hospital
 1930-1931 Research Fellow in Surgery, Harvard Medical School
 1931-1932 Fellow in Medicine, School of Medicine, University of Pennsylvania
 1931-1937 Assistant Surgeon, Pennsylvania Hospital
 1933-1934 Research Fellow in Surgery, Harvard Medical School
 1936-1942 Assistant Surgeon, Bryn Mawr Hospital
 1936-1942 Harrison Fellow of Surgical Research, School of Medicine, University of Pennsylvania
 1937-1950 Surgeon, Pennsylvania Hospital
 1945-1946 Assistant Professor of Surgery, University of Pennsylvania
 1946-1956 Professor of Surgery and Director of Surgical Research, Jefferson Medical College
 1946-1956 Attending Surgeon, Jefferson Medical College Hospital
 1950-1967 Consulting Surgeon, Pennsylvania Hospital
 1950-1967 Consultant in General Surgery, Veterans Administration Hospital, Philadelphia

- 1956–1967 Samuel D. Gross Professor of Surgery and Head of the Department, Jefferson Medical College and Hospital
- 1956–1967 Attending Surgeon-in-Chief, Jefferson Medical College and Hospital
- 1967–1973 Samuel D. Gross Professor of Surgery, Emeritus, Jefferson Medical College and Hospital

VISITING PROFESSORSHIPS AND LECTURESHIPS

- George A. Ball Visiting Professor of Surgery, Indiana University, 1956
- Taub Visiting Professor of Surgery, Baylor University, 1959
- Visiting Professor of Surgery, Harvard Medical School, 1960
- Barney Brooks Visiting Professor of Surgery, Vanderbilt University, 1967
- Churchill Lecture, Excelsior Surgical Society, 1956
- Harvey Lecture, New York Academy of Medicine, 1958
- Conner Memorial Lecture, American Heart Association, 1958
- Alvarenga Prize and Lectureship, College of Physicians of Philadelphia, 1962
- Arthur Dean Bevan Lecture, Chicago Surgical Society, 1962

LEARNED SOCIETY MEMBERSHIPS

- American Association of Arts and Sciences
- American Association for Artificial Internal Organs
- American Association for Thoracic Surgery (President, 1960–1961; Council, 1949–1954; Representative to American Cancer Society, Advisory Committee on Lung Cancer Case Finding, 1954)
- American Cancer Society
- American Cancer Society, Philadelphia Division
- American College of Surgeons (Fellow; Board of Governors, 1950–1964; Executive Committee of Program Committee; Graduate Training Committee)
- American Heart Association
- American Medical Association
- American Medical Writers Association
- American Surgical Association (Recorder, 1947–1952; Vice-President, 1953; President, 1954; Council, 1955–1958)
- Association of American Medical Colleges

- College of Physicians of Philadelphia (Council, 1954; Vice-President, 1961–1964; President, 1964–1967; Censor, 1967)
- Halsted Society
- Heart Association of Southeastern Pennsylvania (Research Committee Chairman, 1966; Board of Governors; President, 1958–1959)
- International Cardiovascular Society
- International Society of Surgery
- International Surgical Group
- J. Aitken Meigs Medical Society
- Laennec Society of Philadelphia, President
- Pennsylvania Association for Thoracic Surgery (President, 1963–1964)
- Pennsylvania Heart Association (State Research Committee, 1966)
- Pennsylvania Public Health Association
- Pennsylvania State Medical Society, Commission on Promotion of Medical Research
- Pennsylvania Trudeau Society
- Philadelphia Academy of Surgery (Vice-President, 1953–1956; President, 1956–1958; Council, 1958–1960)
- Philadelphia County Medical Society (Alternate Delegate-at-Large to Pennsylvania Medical Society, 1961–1963)
- Pulmonary Neoplasm Research Group of Philadelphia, Medical Advisory Committee
- Society of Clinical Surgery (Treasurer; President, 1953–1954)
- Society of Surgical Chairmen
- Society of University Professors
- Society for Vascular Surgery (President, 1964–1965)
- World Medical Association
- National Academy of Sciences (elected, 1972)

HONORARY MEMBERSHIPS

- Chicago Surgical Society, 1962
- Buffalo Surgical Society, 1966
- Society of Thoracic Surgeons of Great Britain and Ireland, 1961
- Fellow of the Royal College of Surgeons of England, 1959

EDITORIAL BOARD MEMBERSHIPS

- 1947–1973 *Annals of Surgery* (Chairman, 1947–1957)
- 1959–1963 *Circulation Research*

COMMITTEE MEMBERSHIPS

- United States Public Health Service, Surgery Study Section
 City of Philadelphia, Board of Health
 Committee on International Exchange of Persons
 National Heart Institute, Board of Scientific Counselors
 Conference Committee on Graduate Training in Surgery (Chairman, 1961–1963)
 American Board of Surgery (Examination Committee, 1953–1956; Chairman, 1955–1956; Emeritus Member, 1956–1973)
 National Board of Medical Examiners, Examination Committee for Surgery
 National Research Council, Subcommittee on Cardiovascular System
 American Cancer Society, Advisory Committee on Research of the Therapy of Cancer
 American Heart Association, Subcommittee on the Cardiovascular System
 Board of City Trusts of Philadelphia, Advisory Committee, John Scott Award
 City of Philadelphia, Hospital Survey Committee
 The Philadelphia Award, Board of Trustees
 The Gairdner Foundation, Awards Committee
 Phaler Foundation, Advisory Committee

AWARDS

- 1953 John Scott Award, Board of Directors of City Trusts of Philadelphia
 1957 Charles Mickle Fellowship, University of Toronto
 1957 Clarence E. Shaffrey, S. J. Medal, St. Joseph's College Medical Alumni
 1958 Rudolph Matas Award in Vascular Surgery, Tulane University
 1959 Distinguished Service Award, International Society of Surgery
 1963 Strittmatter Award, Philadelphia County Medical Society
 1964 The Philadelphia Award
 1965 Research Achievement Award, American Heart Association
 1966 Roswell Park Medal
 1968 Albert Lasker Clinical Research Award
 1972 Dixon Prize in Medicine, University of Pennsylvania

BIBLIOGRAPHY

1930

- With Richard Middleton. The prognostic value of the initial leukocyte and differential count in lobar pneumonia. *Am. J. Med. Sci.*, 180:31-36.
- With Edward D. Churchill. Changes in the pulmonary circulation induced by experimentally produced arteriovenous fistula. *Arch. Surg.*, 21:1188-94.

1931

- With Edward D. Churchill. Mechanical influence of the pericardium upon cardiac function. *J. Clin. Invest.*, 10:405-22.

1932

- With Mary Hopkinson and Edward D. Churchill. Changes in the circulation produced by gradual occlusion of the pulmonary artery. *J. Clin. Invest.*, 11:543-53.
- With Eugene M. Landis. Vasodilatation in the lower extremities in response to immersing the forearms in warm water. *J. Clin. Invest.*, 11:1019-36.

1933

- With Eugene M. Landis. The effects of temperature and tissue pressure on the movement of fluid through the human capillary wall. *J. Clin. Invest.*, 12:105-38.
- With Eugene M. Landis. Effects of alternate suction and pressure on blood flow to the lower extremities. *J. Clin. Invest.*, 12:925-61.
- With Eugene M. Landis. The effects of alternate suction and pressure on circulation in the lower extremities. *Proc. Soc. Exp. Biol. Med.*, 30:593-95.
- With Eugene M. Landis. A simple method of producing vasodilatation in the lower extremities, with reference to its usefulness in studies of peripheral vascular disease. *Arch. Intern. Med.*, 52:785-808.

1934

- Actinomycosis of abdominal wall. *Ann. Surg.*, 99:861-64.

With John B. Flick. Pericardiectomy for advanced Pick's disease. *Arch. Surg.*, 29:126-37.

1936

With John B. Flick. Total removal of left lung for carcinoma. *Ann. Surg.*, 103:130-34.

With Edward D. Churchill. The physiology of massive pulmonary embolism; experimental study of the changes produced by obstruction to the flow of blood through the pulmonary artery and its lobar branches. *Ann. Surg.*, 104:811-22.

With John B. Flick. The application of thoracoplasty to the treatment of pulmonary tuberculosis. *Pa. Med. J.*, 39:768-72.

Artificial maintenance of the circulation during experimental occlusion of the pulmonary artery. *Arch. Surg.*, 34:1105-31.

1937

With John B. Flick. Hyperparathyroidism relieved by removal of a parathyroid tumor. *Bull. Ayer Clin. Lab. Pa. Hosp.*, 3:73-78.

1939

Pulmonary embolism; a review of recent contributions. *Pa. Med. J.*, 42:877-80.

With Francis C. Grant and Lawrence M. Weinberger. Anoxia of the central nervous system produced by temporary complete arrest of circulation. *Trans. Am. Neurol. Assoc.*, 65:66-72.

An oxygenator with a large surface-volume ratio. *J. Lab. Clin. Med.*, 24:1192-98.

The immediate effect of scalenotomy upon the size of apical tuberculous cavities. *J. Thorac. Surg.*, 8:633-37.

The maintenance of life during experimental occlusion of the pulmonary artery followed by survival. *Surg. Gynecol. Obstet.*, 69:602-14.

With Harold Smith. Blood chemical aids to surgical therapy. *Surg. Clin. North Am.*, 19:1583-94.

1940

With Lawrence M. Weinberger and Mary H. Gibbon. Temporary arrest of the circulation to the central nervous system. I. Physiologic effects. *Arch. Neurol. Psychiatry*, 43:615-34.

With Lawrence M. Weinberger and Mary H. Gibbon. Temporary arrest of the circulation to the central nervous system. II. Pathologic effects. *Arch. Neurol. Psychiatry*, 43:961-86.

1941

With Charles W. Kraul. An efficient oxygenator for blood. *J. Lab. Clin. Med.*, 26:1803-9.

With Clare C. Hodge. Aseptic immediate anastomosis following resection of the colon for carcinoma. *Ann. Surg.*, 114:635-52.

With Clare C. Hodge. The treatment of minor war injuries. *Med. Clin. North Am.*, 25:1829-42.

With Frank F. Allbritten, Jr., and John B. Flick. The use of sulfanilamide in partial and total resection of the lung. *J. Thorac. Surg.*, 11:187-97.

1942

With Mary H. Gibbon and Charles W. Kraul. Experimental pulmonary edema following lobectomy and blood transfusion. *J. Thorac. Surg.*, 12:60-77.

With Mary H. Gibbon. Experimental pulmonary edema following lobectomy and plasma infusion. *Surgery*, 12:694-704.

1946

With Leslie W. Freeman. The primary closure of decubitus ulcers. *Ann. Surg.*, 124:1148-64.

With Louis H. Clerf, Peter A. Herbut, and John J. DeTuerk. The diagnosis and operability of bronchogenic carcinoma. *J. Thorac. Surg.*, 17:419-27.

1949

With John Y. Templeton III. Experimental reconstruction of cardiac valves by venous and pericardial grafts. *Ann. Surg.*, 129:161-76.

Cancer of the lung (Thomas Dent Mutter lecture). LXI. *Trans. Stud. Coll. Physicians Philadelphia*, 17:49-60.

With Bernard J. Miller and Frank F. Allbritten, Jr. Blood volume and extracellular fluid changes during thoracic operations. *J. Thorac. Surg.*, 18:605-15.

With Joseph W. Stayman, Jr. Symposium on recent advances in surgical physiology; physiology of cardiac surgery. *Surg. Clin. North Am.*, 29:1731-43.

1950

With Frank F. Allbritten, Jr., Herbert Lipshutz, and Bernard J. Miller. Blood volume changes in tuberculous patients treated by thoracoplasty. *J. Thorac. Surg.*, 19:71-79.

With Franz Goldstein, Frank F. Allbritten, Jr., and Joseph W. Stayman, Jr. The combined manometric determination of oxygen and carbon dioxide in blood, in the presence of low concentrations of ethyl ether. *J. Biol. Chem.*, 182:815-20.

With John E. Healey, Jr. Intrapericardial anatomy in relation to pneumonectomy for pulmonary carcinoma. *J. Thorac. Surg.*, 19:864-74.

John S. Lockwood. *Ann. Surg.*, 132:161.

Controlled respiration in thoracic and upper abdominal operations. *Minn. Med.*, 33:1031-34.

With Frank F. Allbritten, Jr., Joseph W. Stayman, Jr., and James M. Judd. A clinical study of respiratory exchange during prolonged operations with an open thorax. *Ann. Surg.*, 132:611-25.

With Frank F. Allbritten, Jr. Recent advances in the surgical treatment of carcinoma of the esophagus; discussion of esophagogastrostomy. *Pa. Med. J.*, 53:811-16.

With Thomas L. Stokes, Jr. Bronchiectasis. In: *Cyclopedia of Medicine, Surgery and Specialties*, ed. George M. Piersol and Edward L. Bortz, 3d. ed., vol. 2, p. 751. Philadelphia: F. A. Davis.

With Joseph W. Stayman, Jr., and Frank F. Allbritten, Jr. Controlled respiration in thoracic surgery. *J. Int. Chir.*, 10:106-11.

Carcinoma of the lung with an analysis of symptoms and end results in 243 cases. *Chicago Med. Soc. Bull.*, 13:945-48.

1951

With Frank F. Allbritten, Jr., and John Y. Templeton III. Carcinoma of the esophagus and gastric cardia. *J. Am. Med. Assoc.*, 145:1035-40.

Cancer of the esophagus. *Med. Rec. Ann.*, 45:600-602.

With Robert K. Finley, Jr., John Y. Templeton III, and Robert H. Holland. Changes in urine and serum electrolytes and plasma

volumes after major intrathoracic operations. *J. Thorac. Surg.*, 22:219-34.

With Bernard J. Miller and Mary H. Gibbon. Recent advances in the development of a mechanical heart and lung apparatus. *Ann. Surg.*, 134:694-708.

With John Y. Templeton III and Frank F. Allbritten, Jr. Symposium on abdominal surgery; total gastrectomy. *Surg. Clin. North Am.*, 31:1713-20.

An extracorporeal circulation for the temporary maintenance of the cardiorespiratory functions. *Fourteenth Congress de la Societ e Internationale de Chirurgie*, pp. 984-91. Brussels: Imprimerie M edicale et Scientifique.

With John Y. Templeton III and Robert K. Finley, Jr. Body fluids and electrolytes, blood volume and shock—observations on thiocyanate space, serum electrolytes and acid base equilibrium in patients with intrathoracic disease. *Surg. Forum*, 2:589-95.

1952

The present status of mechanical heart and lungs. *Med. Rec. Ann.*, 46:872-76.

With Frank F. Allbritten, Jr., Thomas F. Nealon, Jr., and John Y. Templeton III. Symposium on safeguards in surgical diagnosis; the diagnosis of lung cancer. *Surg. Clin. North Am.*, 32:1657-72.

The pathogenesis and treatment of pulmonary edema in relation to surgery (annual address for 1946). *Trans. Philadelphia Acad. Surg.*, 37:46-67.

1953

With Bernard J. Miller and Charles Fineberg. Symposium on clinical medicine; an improved mechanical heart and lung apparatus; its use during open cardiomy in experimental animals. *Med. Clin. North Am.*, 37:1603-24.

With Frank F. Allbritten, Jr., John Y. Templeton III, and Thomas F. Nealon, Jr. Cancer of the lung—an analysis of 532 consecutive cases. *Ann. Surg.*, 138:489-501.

With Bernard J. Miller, Victor F. Greco, Harold C. Cohn, and Frank F. Allbritten, Jr. The use of a vent for the left ventricle as a means of avoiding air embolism to the systemic circulation during open cardiomy with the maintenance of the cardiores-

piratory function of animals by a pump oxygenator. *Surg. Forum*, 4:29-33.

With Bernard J. Miller, Victor F. Greco, Burgess A. Smith, Harold C. Cohn, and Frank F. Allbritten, Jr. The production and repair of interatrial septal defects under direct vision with the assistance of an extracorporeal pump oxygenator circuit. *J. Thorac. Surg.*, 26:598-616.

In memoriam: Samuel Clark Harvey. *Ann. Surg.*, 138:679.

1954

Everett Idris Evans. *Ann. Surg.*, 139:257.

With Thomas F. Nealon, Jr. Cancer of the lung. In: *Seminar*, pp. 20-28. Philadelphia: Merck, Sharp, and Dohme.

The application of a mechanical heart and lung apparatus to cardiac surgery. *Minn. Med.*, 37:171-80.

With Frank F. Allbritten, Jr., John Y. Templeton III, Robert K. Finley, Jr., Jose H. Amadeo, and Daniel W. Lewis. The results of mitral valvotomy for mitral stenosis. *Ann. Surg.*, 139:786-96.

With Bernard J. Miller, Arthur R. C. Dobell, Hans C. Engel, and George B. Voigt. The closure of interventricular septal defects in dogs during open cardiectomy with maintenance of the cardiorespiratory functions by a pump-oxygenator. *J. Thorac. Surg.*, 28:235-40.

With Louis H. Clerf, Peter A. Herbut, and Thomas F. Nealon. The lung. In: *Pennsylvania Cancer Manual. An Up-to-date Guide For the Practicing Physician*, ed. Robert C. Horn, Jr., David W. Clare, W. Kenneth Clark, and Benjamin Schneider, chapter 43. Pittsburgh: The Pittsburgh Press.

1955

With Thomas F. Nealon, Jr., George J. Haupt, and Joyce E. Price. Pulmonary ventilation during open thoracotomy: inflation and deflation time ratios and pressures. *J. Thorac. Surg.*, 30:655-75.

With Thomas L. Stokes, Jr., and John J. McKeown, Jr. Surgical treatment of carcinoma of the lung. *Am. J. Surg.*, 89:484-93.

With George J. Haupt. Symposium on applied physiology in modern surgery; the need for adequate pulmonary ventilation during surgical operations. *Surg. Clin. North Am.*, 35:1553-71.

The education of a surgeon (Presidential address). *Ann. Surg.*, 142:321–28.

1956

With Thomas F. Nealon, Jr., and Victor F. Greco. A modification of Glassman's gastrostomy with results in 18 patients. *Ann. Surg.*, 43:838–44.

With Hans C. Engel. Congenital malformations of the heart and great vessels. In: *Cole's Operative Technique. Specialty Surgery*, p. 119. New York: Appleton-Century-Crofts.

With Thomas F. Nealon, Jr., and Joyce E. Price. Respiratory acidosis of pulmonary ventilation during open thoracotomy—the effect of compression of the lung. *Surg. Forum*, 7:193–96.

With Thomas F. Nealon, Jr., George J. Haupt, Harold Chase, and Joyce E. Price. Insufficient carbon dioxide absorption requiring increased pulmonary ventilation during operations with open thoracotomy. *J. Thorac. Surg.*, 32:464–80.

1957

With Thomas F. Nealon, Jr. Carcinoma of the lung and tumors of the thorax. In: *Surgery, Principles and Practice*, ed. J. G. Allen, H. N. Harkins, C. A. Moyer, and J. E. Rhoads, p. 1205. Philadelphia: J. B. Lippincott.

With Thomas F. Nealon, Jr., and Harold F. Chase. Factors influencing the adequacy of carbon dioxide absorption in clinical anesthesia. *Anesthesiology*, 19:75–81.

With John Y. Templeton III and Thomas F. Nealon, Jr. Factors influencing the survival of patients with cancer of the lung. *Ann. Surg.*, 145:637–41.

With Thomas F. Nealon, Jr. Symposium on common operations—refinements in technique. Technique of pneumonectomy. *Surg. Clin. North Am.*, 37:1551–63.

1958

With John Y. Templeton III. Current status of pump oxygenators in cardiac surgery and persistent problems in their use. *Prog. Cardiovasc. Dis.*, 1:56–65.

With John Y. Templeton III. Evaluation of current cardiac surgical procedures. *J. Newark Beth Isr. Hosp.*, 9:87–96.

- With Thomas F. Nealon, Jr., and Joyce E. Price. The importance of measuring ventilation during the steady state. *Surg. Forum*, 8:458-65.
- With Richard T. Cathcart, Thomas F. Nealon, Jr., William Fraimow, and Louis J. Hampton. Cardiac output under general anesthesia. The effect of mean endotracheal pressure. *Ann. Surg.*, 148:488-97.
- With Thomas F. Nealon, Jr. The effect of position on pulmonary ventilation. *J. Thorac. Surg.*, 36:459-554.
- With David C. Schechter and Thomas F. Nealon, Jr. Recipient set for removal of potassium and ammonium from bank blood. *Arch. Surg.*, 77:944-46.
- Extracorporeal maintenance of cardiorespiratory functions. *Harvey Lectures*, vol. 53, pp. 186-224. New York: Academic Press.
- With David C. Schechter and Thomas F. Nealon, Jr. A simple extracorporeal device for reducing elevated blood ammonia levels; preliminary report. *Surgery*, 44:892-97.
- With David C. Schechter and Thomas F. Nealon, Jr. An ion exchange resin type artificial kidney. *Surg. Forum*, 9:110-114.

1959

- With David C. Schechter and Thomas F. Nealon, Jr. The removal of excessive potassium and ammonium from bank blood prior to transfusion. *Surg. Gynecol. Obstet.*, 108:1-6.
- With Thomas F. Nealon, Jr., Richard T. Cathcart, William Fraimow, and Edward D. McLaughlin. The effect of mean endotracheal pressure on the cardiac output of patients undergoing intrathoracic operations. *J. Thorac. Surg.*, 38:449-57.
- With Thomas F. Nealon, Jr. Carcinoma of the lung. In: *Current Therapy*, p. 73. Howard, Conn.: W. B. Saunders.
- Maintenance of cardiorespiratory functions by extracorporeal circulation (The Lewis A. Conner Memorial Lecture). *Circulation*, 19:646-56.
- With Thomas F. Nealon, Jr., and Joyce E. Price. The effect of compression of the lung on pulmonary ventilation. *Surg. Forum*, 7:193-96.

1960

- With Thomas F. Nealon, Jr. Preoperative and postoperative management in the treatment of neoplasms of the chest. In: *Treat-*

ment of Cancer and Allied Diseases, ed. G. T. Pack and I. M. Ariel, vol. 4, p. 279. New York: Paul B. Hoeber.

With Charles Fineberg and Nicholas P. Foris. Experimental sham coronary endarterectomy with and without coronary artery perfusion. *Surgery*, 47:160-64.

With Edward D. McLaughlin and Thomas F. Nealon, Jr. Treatment of bank blood by resins. *J. Thorac. Surg.*, 40:602-10.

With Walter F. Ballinger II, John Y. Templeton III, and Thomas F. Nealon, Jr. The complications of esophageal hiatal hernia. *Pa. Med. J.*, 63:51-56.

With George J. Haupt, Rudolph C. Camishion, and John Y. Templeton III. Treatment of malignant pleural effusions by talc poudrage. *J. Am. Med. Assoc.*, 172:918-21.

With Thomas F. Nealon, Jr. Recent advances in surgical research and their clinical applications; the physiological effects of pulmonary ventilation during operations under general anesthesia. *Surg. Clin. North Am.*, 40:1491-1502.

1961

With Thomas F. Nealon, Jr., John Y. Templeton III, and Vincent D. Cuddy. Instrumental perforation of the esophagus. *J. Thorac. Surg.*, 41:75-79.

With Rudolph C. Camishion and John Y. Templeton III. Leiomyoma of the esophagus: review of the literature and report of two cases. *Ann. Surg.*, 153:951-56.

Broncho-esophagology and thoracic surgery. The team effort. *Trans. Am. Bronchoesoph. Assoc.*, 41:19-24.

With Rudolph C. Camishion, Yoshinori Ota, and Vincent D. Cuddy. Pulmonary arterial blood flow through an acutely atelectatic lung. *J. Thorac. Surg.*, 42:599-614.

Anesthesia and pulmonary problems. *Surg. Gynecol. Obstet.*, 112:223-27.

The road ahead for thoracic surgery (Presidential address). *J. Thorac. Surg.*, 42:141-49.

With Rudolph C. Camishion and Yoshinori Ota. Blood flow through the superior mesenteric artery with antegrade and retrograde perfusion of the aorta. *Circulation*, 24:900.

1962

With Rudolph C. Camishion and Thomas F. Nealon, Jr. Methods

of improving morbidity and mortality rates in standard operations; talc poudrage in the treatment of pleural effusion due to cancer. *Surg. Clin. North Am.*, 42:1521-26.

With Jerome L. Sandler and Thomas F. Nealon, Jr. Clinical experience with a cation exchange resin in the treatment of stored blood. *J. Cardiovasc. Surg.*, 3:94-98.

With Yoshinori Ota and Rudolph C. Camishion. *Dirofilaria immitis* (heart worms) and *Depetalonema* species as causes of "transfusion reactions" in dogs. *Surgery*, 51:518-26.

Surgery of the Chest (editor). Philadelphia: W. B. Saunders.

1963

With Rudolph C. Camishion, Leon P. Scicchitano, and Robert Trotta. Blood flow through the superior mesenteric artery during retrograde aortic perfusion. *Surgery*, 54:651-55.

1965

With Thomas F. Nealon, Jr. The lung, the trachea and the pleura. In: *Management of the Patient with Cancer*, ed. Thomas F. Nealon, Jr., p. 470. Philadelphia: W. B. Saunders.

1966

With Rudolph C. Camishion, Louis Pierucci, and Junzo Iida. Paralysis of the left recurrent laryngeal nerve secondary to mitral valvular disease: report of two cases and review of the literature. *Ann. Surg.*, 163:818-28.

The artificial intracorporeal heart (Presidential address). *Surgery*, 59:1-5.

1967

The early development of an extracorporeal circulation with an artificial heart and lung. *Trans. Am. Soc. Artif. Intern. Organs*, 13:77-79.

1969

With David C. Sabiston and Frank C. Spencer, eds. *Surgery of the Chest*, 2d. ed. Philadelphia: W. B. Saunders.

1970

With Thomas F. Nealon, Jr., and Joseph McCloskey. Cáncer de pulmón: reflexiones y revisión del significado de las metástasis linfáticas. *Prensa Med. Argent.*, 57:1244-47.

The development of the heart-lung apparatus. *Rev. Surg.*, 27:231-44.

1971

Memoir of J. Parsons Schaeffer, 1878-1970. *Trans. Stud. Coll. Physicians Philadelphia*, 38:249-51.