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Jefferson Medical College

Chapter 9

Jeffersonians On The Winged Ox
On November 24, 1975, a sculpture of the Winged Ox of Saint Luke was placed atop a column between the Orlowitz Residence and the Scott Library/Administration Building (Fig. 1). It was dedicated on May 24, 1976. The 18-foot supportive column bears fifty great names in medicine throughout the centuries. Arranged in a spiral, they start with Hippocrates and end at the top with John Heysham Gibbon, Jr.

The names were selected by George M. Norwood, Jr., Interim University President (1976/77) in consultation with Robert T. Lentz, M.S., Sc.D., Head Librarian (1949-75). Five of the names were those of Jefferson Alumni: Samuel D. Gross (1828), J. Marion Sims (1835), Silas Weir Mitchell (1850), Carlos Finlay (1855); and John Heysham Gibbon, Jr. (1927). The choice was difficult and arbitrary because there were so many names not only from the great physicians of the world but also because of the necessity to exclude worthy Jeffersonians such as Robley Dunglison (Father of American Physiology), William W. Keen (JMC, 1862, a pioneer neurosurgeon) and Chevalier Jackson (JMC, 1886, inventor of the bronchoscope). From an intermediate distance the column with its spiral of names was intended by the sculptor to resemble a caduceus, one of the symbols of a physician.

How Saint Luke the physician became symbolized by the ox is a matter of conjecture and unfounded tradition. Iranaeus, a Bishop of Lyon, France, who was killed as a martyr in 202 A.D., is credited with ascribing the ox, the traditional symbol of sacrifice, to Luke because his gospel opens with a sacrifice by Zachariah in the Temple and also deals with the sacrificial death of Christ. The early Christian Church, which used much symbolic imagery, sometimes added wings to representations of the four evangelists. Medieval scholars sought for explanation in the gospels: Matthew, a man, because his book begins with the tree of the ancestors of Christ; Mark, depicted as a lion; Luke, an ox, a sacrificial beast, associated with the sacrifice by Zachariah; and John, an eagle, the bird that flies nearest to heaven since his gospel gives the clearest vision of God.

Particularly relevant to Luke the physician, the sacrifice of a bull, steer or calf at sacramental feasts was thought to imply superhuman powers for fighting disease. The concept of self sacrifice seemed a fitting association to the ideal of a physician.

The Winged Ox was the result of a sculpture competition in 1975 under the mandate of the Philadelphia Redevelopment Authority, which required the use of one percent of the construction costs for the Scott and Orlowitz buildings for artistic purposes. Mr. Henry Mitchell, a sculptor living at the time in Locarno, Switzerland, learned of the contest just three weeks before the deadline for entry. Once his idea of the Winged Ox was conceived, he quickly finished a model in wax over copper armature. Mitchell took the precaution of sending three bronze models, a security measure that proved to be a wise one. They arrived safely across the Atlantic but the first model was stolen from the jury room at Jefferson. The second model was substituted and chosen as the winner. The third model was purchased by Mrs. William W. Bodine as a Christmas present for her husband, Chairman of the Board of Thomas Jefferson University. It took about seven months for Mr. Mitchell to complete the entire bronze casting. The steps in this complex process are detailed in the Jefferson Alumni Bulletin for summer, 1976, in an article by Joy Roff Mara "Fire and Excitement in Bronze."

The fifty famous names listed on the Winged Ox are as follows:

Fig. 1. The Winged Ox, symbol of Saint Luke the physician.
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HIPPOCRATES, 460-370 B.C.
Gave Greek medicine its scientific spirit and ethical ideals.

AULUS CORNELIUS CELSUS, 53 B.C. - 7 A.D.
Compiled encyclopedic treatises on Roman medicine.

SORANUS OF EPHESUS, 2d century A.D.
Leading authority on gynecology, obstetrics and pediatrics of antiquity.

GALEN, 131-201 A.D.
Greek physician, anatomist and physiologist; most voluminous of all ancient writers and authority for nearly 14 centuries.

RHAZES, 860-932
Persian physician who gave first authentic account of smallpox and measles.

MAIMONIDES, 1135-1204
Jewish physician and philosopher who translated the authoritative storehouse of medieval medicine from Arabic into Hebrew.

PARACELSUS, 1493-1541
Founder of chemical pharmacology and therapeutics.

AMBROISE PARE, 1510-90
Greatest of all army surgeons; discredited the use of boiling oil in war wounds.

MICHAEL SERVETUS, 1509-53
Discovered that blood in the pulmonary circulation passes into the heart after being mixed with air in the lungs.

ANDREAS VESALIUS, 1514-64
Made anatomy a science.

WILLIAM HARVEY, 1578-1657
Greatest name in 17th century medicine; showed the blood to be in motion and follow a definite path, establishing physiology as a dynamic science.

THOMAS WILLIS, 1621-75
London clinician; contributed to anatomy of the nervous system and described circulation at base of the brain ("Circle of Willis").

MARCELLO MALPIGHI, 1628-94
Great microscopist and founder of histology.

ANTON VAN LEEUWENHOEK, 1632-1723
Dutch microscopist who first described spermatozoa and gave first complete account of red blood cells.

HERMAN BOERHAAVE, 1668-1738
Leading clinician of his time; great teacher and chemist.

GIOVANNI BATTISTA MORGAGNI, 1682-1771
Founder of modern pathological anatomy.

ALBRECHT VON HALLER, 1708-77
Master physiologist of his time; Samuel D. Gross named one of his sons after him.

JOHN HUNTER, 1728-93
Founder of scientific surgery based on physiology and pathology.

JOHN MORGAN, 1735-89
Early advocate of medical education in the United States and a founder of Medical School of University of Pennsylvania.

PHILIPPE PINEL, 1745-1826
First to treat the insane in a humane manner.

BENJAMIN RUSH, 1745-1813
First great physician in America and "Father of American Psychiatry."

EDWARD JENNER, 1749-1823
Developed preventive inoculation against smallpox.

RENE THEOPHILE HYACINTHE LAENNEC, 1781-1826
Inventor of the stethoscope, putting diagnostic sounds of cardiac and pulmonary diseases upon a reliable basis.

RICHARD BRIGHT, 1789-1858
Described inflammation of kidneys now known as "Bright’s Disease."
THOMAS ADDISON, 1793-1860
Described pernicious anemia and disease of the suprarenal glands.

ROBERT JAMES GRAVES, 1796-1853
Described exophthalmic goiter associated with hyperthyroidism.

SAMUEL DAVID GROSS, 1805-84
Greatest American surgeon of his time.

CLAUDE BERNARD, 1813-78
Greatest physiologist of modern France.

JAMES MARION SIMS, 1813-83
Found a cure for vesicovaginal fistula and opened first hospital devoted entirely to diseases of women. "Father of Modern American Gynecology."

FLORENCE NIGHTINGALE, 1823-1910
Instituted nursing as a profession.

IGNAZ PHILLIPP SEMMELWEIS, 1818-65
Pioneer in prevention of puerperal fever.

WILLIAM THOMAS GREEN MORTON, 1819-68
Introduced ether anesthesia to the medical profession.

RUDOLPH VIRCHOW, 1821-1902
Founder of cellular pathology.

LOUIS PASTEUR, 1822-95
Chemist/Bacteriologist and pioneer in preventive inoculation.

JEAN MARTIN CHARCOT, 1825-93
French master neurologist; created the greatest neurologic clinic of his time in Paris.

LORD JOSEPH LISTER, 1827-1912
London surgeon who introduced antiseptic technic.

SILAS WEIR MITCHELL, 1829-1914
Physician, neuropsychiatrist, scientist and novelist.

CARLOS FINLAY, 1833-1915
Suggested a mosquito as the vector of yellow fever.

ROBERT KOCH, 1843-1910
Discovered the tubercle bacillus.

WILHELM KONRAD ROENTGEN, 1845-1923
Discoverer of X-rays.

WILLIAM OSLER, 1849-1919
Premier teacher of clinical medicine and medical philosopher.

IVAN PETROVICH PAVLOFF, 1849-1936
Nobel prize winner in experimental gastroenterology; described "conditioned reflex".

WILLIAM HENRY WELCH, 1850-1934
Advanced the science of bacteriology and pathology in America.

WALTER REED, 1851-1902
A conqueror of yellow fever.

RAMON Y CAJAL, 1852-1935
Gifted illustrator of the nervous system.

PAUL EHRlich, 1854-1915
Biochemical researcher who discovered salvarsan ("606") for cure of syphilis.

SIGMUND FREUD, 1856-1939
Developed psychoanalysis.

MADAME MARIE CURIE, 1867-1934
Discoverer of radium.

HARVEY CUSHING, 1869-1939
Pioneer neurosurgeon and investigator of diseases of the pituitary gland.

JOHN HEYSHAM GIBBON, JR., 1903-1973
Developed the heart-lung machine and performed the first successful open heart operation.

The Winged Ox, as a fitting complement to the Scott Building, combines legend and lore with Jefferson's tradition and heritage.
Finding the Birthplace of Samuel D. Gross

In the Spring of 1990, an exciting event occurred in the ongoing research into the life of Samuel D. Gross, Jefferson's most famous alumnus. This was the finding of the exact site of his birthplace. It is not to be construed that the general location of his birthplace had not been known. Indeed, it is stated in his many memoirs and autobiography that it was on a farm within two miles of Easton, Pennsylvania. One might assume that after the lapse of 185 years attempts to find the exact site would prove fruitless. The editors' curiosity was aroused by a slide depicting the birthplace in the collection of Edward E. Harnagel (JMC, '43), an avid historian of Gross. Unfortunately, Dr. Harnagel could not recall how he had obtained the picture of the Gross birthplace 25 years previously. This created a mystery and a challenge which the editors pursued relentlessly.

Through his associations in the American Osler Society, Dr. Wagner was contacted by Dr. Mason G. Robertson of Savannah, Georgia, who at the time was researching the Easton years of Samuel D. Gross. The question of the Gross birthplace accordingly became one of mutual interest and Dr. Wagner supplied Dr. Robertson with a picture taken from Dr. Harnagel's slide. Dr. Robertson obtained the name of Dr. Charles Waltman, a retired Easton surgeon, who had been President of the Northampton County Historical Society, and who volunteered in the search for the birthplace. Dr. Waltman sent Dr. Robertson an article by C.W.G. Rohrer entitled Professor Samuel D. Gross: America's Foremost Surgeon, written in 1912, which contained a photograph of the Gross birthplace, the same as on Dr. Harnagel's slide (Fig. 1). That cleared the mystery of the origin of the picture on the slide.

Dr. Waltman, who knew the Easton area well, was initially unsuccessful in finding any residence resembling the one published in the article. In a second search, however, he pin-pointed the probable site at or near the Chesterfield Inn, where he took some photographs on the premises. The owner came out to inquire about his intentions, whereupon Dr. Waltman explained his historical interest. The intrigued owner took him to the rear of the Inn where there stood a house which appeared identical to the antiquated one on the old photograph (Fig. 2). This important finding was promptly circulated to all the interested parties. The editors could hardly wait to make a pilgrimage to verify the facts. This took place in May, 1990, when the Waltmans, Wagners, and Savacools met for lunch at the Chesterfield Inn.

The Inn was located on Tatumy Road, Palmer Township, previously Forks Township, of Northampton County. As previously mentioned, the house of Gross's birth was located just to the rear of the Inn. The beautiful rural landscape described by Gross in his autobiography was fortunately well preserved and hardly affected by the urbanization not far distant. Fields of wheat, corn, alfalfa, and soy beans were being expertly farmed by modern methods.

In comparing the present appearance of the house with that of the 1912 photograph, it is clear that the stone of the left half was different from that of the right half on both pictures, but no clue was provided regarding the age of either half. Efforts to determine the date of construction of the house have to date proven fruitless.

It is stated by Gross in his autobiography that the original farm of his father, Philip, consisted of two hundred acres of the "best land" at the time of his birth and that his father "was highly distinguished for his integrity, for the elegance of his farm, and for the beauty of his horses which were among the finest in the country." His father, however, died in 1813 (Fig. 3) when Samuel was only eight years old and his will directed that the farm be sold.

The deeds, which the editors researched in the
Fig. 1. Restored birthplace of Samuel D. Gross. The older half is on the right. (Photo taken in 1912.)

Fig. 2. Restored birthplace of Samuel D. Gross. (Photo taken in 1990.)
The Gross farm was located in a region long known as “The Forks,” meaning the confluence of the Lehigh and Delaware Rivers. It was important as a colonial communication and trade junction as well as a frontier south of the Blue Mountain Range. Many German immigrants from the Rhineland settled there in the late seventeenth and early eighteenth centuries and developed a major agricultural center, already a century old at the time of Gross’ father’s early career. The region was an important source of food and war materials during the Revolution. Philip (Dr. Gross’ father) was the grandson of the first Gross immigrant to the Forks region and by the end of the eighteenth century he had become a major landowner and a respected “upright citizen.” During the Revolution, Philip spent his time and money freely in the service of the government. His will indicates his prosperity but reveals that none of his four sons would succeed him on the farm. He directed that all of his real and personal property be sold and after several specific bequests to his wife and two daughters, he left his residuary estate to three of his sons: Joseph, Samuel and Charles. His oldest son Abraham was cut off with a bequest of five shillings.

Several times during Samuel D. Gross’s early years, he refers to the “patrimony” supporting his education and progress. Since he was only eight years old at his father’s death, the sum he inherited must have been substantial. He stated that it was almost exhausted at the time of his marriage in 1828. His guardian after the death of his father was a maternal uncle who must have lived nearby, since the school he attended was at the border of his farm birthplace (Fig. 4). This uncle was probably Daniel Brown whose farm is stated in a deed recorded in 1814 to adjoin the farm of Philip Gross, deceased. Philip Gross’s wife (Samuel D’s mother) was Juliana Brown Gross.

Fig. 3. Much weather-worn tombstone of Philip Gross (1756-1813), father of Samuel D. Gross, in Forks Cemetery, Stockertown, Pennsylvania.
The elder Gross unquestionably was among the most serious of men. It is just as unquestioned that he had a lighter side. These contrasting aspects of his personality are well exemplified in words taken from his own autobiography as follows:

"I studied hard during the sessions of the college as well as during the recesses; I was always punctually in my seat, and never missed a lecture, except during the second winter, when I was confined for two days to my room by an attack of pleurodynia. I worked early and late, and lost no occasion to profit by the opportunities that were afforded me. I was determined to qualify myself well, especially in the practical branches. I was very fond of anatomy and surgery, and therefore made them objects of particular inquiry. During the eighteen months of my connection with McClellan, I had witnessed many important operations, and had seen a good deal of medical practice. My mind, too, was well disciplined; I had not only industry, but ambition; my morals and habits were good, and I was a stranger to all amusements. Medicine was the goddess of my idolatry. When, therefore, the time for my examination arrived, I had no misgivings in regard to the result. I had planted carefully, and believed that I should ultimately receive the rewards of my industry. The thirty-five minutes which I spent in the 'Green Room' of my Alma Mater were amongst the happiest of my life, and I could not help giving ex-

Fig. 4. Restored building, the site of which was possibly the boyhood schoolhouse of Samuel D. Gross.

The Lighter Side of Dr. Samuel D. Gross
pression to my feelings in the presence of my assembled teachers. Such, indeed, was my hilarity that McClellan, my private preceptor who knew me intimately, was induced to ask me afterward 'whether I had not been drinking?'—although he was well aware that I was one of the most temperate of youths and as sober as a judge on the occasion in question."

Dr. and Mrs. Gross (Figs. 1 and 2) entertained a great deal in their home. These guests were not limited to the medical profession but included intellectuals from the clergy, the military, the political arena, as well as artists and literary people. During the Kentucky years (1840-56), it is stated that "his wife was a charming hostess who kept an ample table ready at all times for reunions in which the strains of music mingled with flashes of wit and humor."
In *Louisiana Swamp Doctor: The Writings of Henry Clay Lewis* (alias *Madison Tensas, M.D.*) there is a description of Dr. Gross examining this particular student in a final examination for the doctorate degree. While the anecdote cannot be accepted as authentic, it does give the flavor of a lighter side of Dr. Gross.

"Now for Old Sawbones Dr. Samuel D. Gross. I am sure of him, though. Upon surgery I was prepared, and my intimacy with that professor assured me he must be aware of it and would attribute the errors I might commit to natural trepidation under the circumstances.

"He was a man of too much good sense to wheedle or fool with, and not withholding my confidence in my good preparation and his appreciation of it, I anticipated a terrible time with him.

"My heart sank as I entered his room. 'Be seated, Mr. Tensas. Beautiful weather for this season. Have an apple? Here is an instrument for ligating the subclavian artery that the maker has done me the honor to call after me. How do you like it? Think I must order a dozen. Do to give to acquaintances: rattled on the kindhearted professor, trying to reassure me, which he failed to do, for I regarded his pleasantry as somewhat akin to the cat sporting with its victim. 'You never shave, Tensas, I believe? Apropos, how old are you?'

"I jumped clear out of my seat at the question. The institution required a candidate to be twenty-one, which I was not by several months.

"It's rather late in the day to inquire that, professor,' replied I. 'You should have asked that before I paid for your ticket.' 'Well, you are old enough to be examined for your degree, I expect, as you'll be rejected in all probability. How do you make chicken soup?'

"I began to get nettled, thinking he was sporting with me upon my embarrassed condition, but a glance at his face told me he was, or strongly pretending to be, in earnest.

"Professor, 'I said', 'I came here, sir, to be examined upon surgery, not to be insulted, sir. What chicken soup has to do with it, I cannot imagine. If you are disposed to twit me with my early life and humble occupation, I can assure you, sir' — "Stop! stop! No insult was intended, and though you with your wisdom of almost twenty-one years can not see the connection between soup and surgery, I can tell you, young man, that the success of the surgeon depends very much upon kitchen medicine. Good soup is easily digested and strengthens the patient, but bad discomposes and prevents the reparative action of the system. But this is not answering my question. How do you, sir, make chicken soup?"

"Seeing that if he was not in earnest it was the best imitation I had seen lately, I vouchsafed to answer the subtle inquiry.

"After I had concluded — "Mr. Tensas, you have left out a very important item in the preparation of your soup. You forgot to mention in the first instance whether you would kill the chicken or not.'

"The glance I shot at him was too much for his gravity. Bursting into a hearty laugh, he said, 'Tensas, I knew you were well prepared, but I thought I would teach you that nothing that may be conducive to the recovery of our patient is too trivial to be remembered by the physicians — also to try your temper. You have too much of the latter. The sickbed is a fine moderator, however. Go, my dear fellow, study hard, and in ten years I will hear from you.'

"Tears sprang into my eyes as I wrung his hand and thanked him on leaving his room."

In a "Discourse Introductory to the Forty-third Course of Lectures" (1867) entitled *Then and Now* Dr. Gross berated unnecessary and meddlesome surgery of the uterus as well as the misuse of pessaries. Much of what he said might be applicable today, but, in addition, his comments were humorous.

"Dr. W.D. Buck, of New Hampshire, in an address before the Medical Society of that State, has so admirably hit off this proclivity, that I cannot forego the pleasure of quoting some of his remarks. Speaking of the uterus as a harmless, inoffensive little organ, stowed away in a quiet place, 'it furnishes,' he jocosely says, 'a capital field for surgical operations, and is nowadays subject to all sorts of barbarity from surgeons anxious for notoriety.
Had Dame Nature foreseen this, she would have made it iron-clad. What with burning and cauterizing, cutting and slashing, and gouging, and spitting and skewering, and pessarying, the old-fashioned womb will cease to exist, except in history. The Transactions of the American Medical Association have figured one hundred and twenty-three different kinds of pessaries, embracing every variety, from a simple plug to a patent threshing machine, which can only be worn with the largest hoops. They look like the drawings of turbine water-wheels, or a leaf from a work on entomology. Pessaries, I suppose, are sometimes useful, but there are more than there is any necessity for. I do think that this filling of the vagina with traps, making a Chinese toyshop of it, is outrageous. Our grandmothers never knew they had wombs, only as they were reminded of it by the struggles of a healthy fetus, which, by the way, they always held on to. Nowadays, even our young women must have their wombs shored up, and if a baby accidentally gets in by the side of the machinery, and finds a lodging in the uterus, it may perchance, have a knitting-needle stuck in its eyes before it has any.”

Finally in the same discourse, Gross said: “A sound hearty, wholesome laugh is medicine for the soul and is one of the peculiar prerogatives of our nature.”

### Eakins’ Gross Clinic: The Acme of Medicine in Art

During the Renaissance, the new study of human anatomy provided common ground for both scientist and artist. Leonardo Da Vinci participated in anatomical research from 1483 to 1515. *The Anatomy Lesson of Dr. Tulp* by Rembrandt (1632) and *The Anatomy Lesson of Dr. Velpeau* by Feyen-Perrin (1864) were famous European precursors for the American masterpiece of Thomas Eakins, *The Gross Clinic* (1875)

Eakins, while an art student in 1864, studied anatomy at the Jefferson Medical College of Philadelphia. A decade later, after nearly four years abroad, he continued his anatomical studies in the same medical school with the renowned father and son anatomists, Joseph and William Pancoast. He also attended the surgery clinics of Dr. Samuel D. Gross, acknowledged by Fielding Garrison as “the greatest American surgeon of his time.” This association led to his painting of *The Gross Clinic*.

Thomas Eakins was a native Philadelphian, born in 1844. His father, Benjamin Eakins, was a well known writing master who was successful in his trade and also in investments. He provided every advantage for the artistic education of his talented son and assured him of life-long financial security so that he could pursue art for its own sake. Thomas Eakins passionately believed that the most beautiful thing in the world was the human body. His natural inclination towards science and mathematics furthered his intense interest in the body’s anatomy. His fascination with medicine, although not for a career, led to his completions of the portraits of seven professors of the Jefferson Medical College. The most enduringly famous of these was Dr. Samuel D. Gross, but Drs. Benjamin H. Rand, John H. Brinton, Jacob M. DaCosta, James Holland, William S. Forbes, and William Thomson were men of great prominence in their fields.

In 1875, Eakins was 31 years of age; his formal artistic education had been completed; and there was a request for American artists to exhibit their best works in the Art Gallery of the forthcoming Philadelphia Exposition Celebrating the 1876 Centennial of American Independence. The time, place, subject matter and challenge were ideal for Eakins’ ambition, now at its peak, to express itself Fig. 1. *The Gross Clinic* by Thomas Eakins.
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in what he believed would be a masterpiece by executing the Portrait of Professor Gross, subsequently known as The Gross Clinic.

On a purely voluntary basis, without commission, Eakins worked with sketches and poses by Dr. Gross for a monument work that he knew was by far the best he had ever done. Within easy access to the Committee of Selection of the Centennial Art Department, it was exhibited in Haseltine’s Gallery in Center City Philadelphia in April of 1876. A crushing disappointment awaited the expectant artist.

The canvas (Fig. 1) graphically depicts a scene familiar to Jefferson Medical College students before the use of Listerian antisepsis more than a century ago. The figures are of life size in a vertically oriented group 8 X 6 1/2 feet and mounted in a massive gilded frame. The towering intellectual figure of Professor Gross with his tremendous power of presence dominates the arena in which he characteristically pauses for a moment to explain to his class the details of removal of a piece of dead bone (sequestrum) from the femur. His intense but compassionate face is bathed in natural light from the overhead skylight of the upper amphitheater of the College, known as the “pit” for its similarity to a bull ring. Since the incandescent lamp would not be invented until four years later, the operations were performed on sunny days between the hours of 11 A.M. and 3 P.M. The absence of caps, masks, gowns and gloves documents the high vulnerability of both patient and surgeon to infection. The bloody hand holding the scalpel, which is a feature as striking as the head of Gross himself, contains pus as well, since there was an abscess at the site of the incision.

With their retractors and hooks to expose the wound, the assistants along with the anesthetizer, all in street garb, form a pyramid about the patient lying on the right side with bare buttocks and wearing heavy socks. Dr. Daniel Apple, who had just graduated that year, is in the right lower corner holding a retractor in one hand and ready to hand an instrument in the other. James M. Barton (JMC, 1868), Chief of Clinic and subsequently a Clinical Professor of Surgery, crouches to the side of the master with his tenaculum. Dr. Charles S. Briggs, later the Professor of Surgery at the University of Nashville, is kneeling at the middle in front of Dr. Gross, holding the patient’s legs to avoid movement during the procedure. He was sent by his father, Dr. W.T. Briggs of Nashville, to study under Gross. The elder Briggs considered Dr. Gross to be the greatest physician in the United States and presented him with a gold-headed cane in 1880.

At the head of the operating table is W. Joseph Hearn (JMC, 1867), in later years a Clinical Professor of Surgery, holding the anesthetic soaked towel to the patient’s face. An unidentified figure, hidden behind Dr. Gross, is holding a retractor in his left hand from the left rear side of Gross while he comforts the mother by intertwining his hand with hers, giving the appearance of six fingers. The mother is shrinking from the sight of her son’s blood on the surgeon’s knife and hand. Although women were considered unfit to witness operations, the law permitted members of the families of charity patients to be present.

In the left middle ground of the portrait is the recorder, Dr. Franklin West, a Jefferson graduate of 1873, taking notes at his desk. Dr. Gross always insisted on accurate records in his personal life, clinics and societies he founded.

The background of the painting is dark since it realistically represents the poor illumination of that era. The figure of Samuel W. Gross the younger (JMC, 1857), is dimly seen in the doorway behind Dr. Barton. To his right is Hughey O’Donnell, the orderly who served the College for many years and collected tumblers of “lausable pus” for Gross’s lectures. Sketching in the stands to the right of Dr. Samuel W. Gross is Thomas Eakins. On the top row, Robert C.V. Myers, a poet friend of Eakins, is portrayed. The medical students are possibly depicted from the Sketch Club classes.

For reasons that were not explicitly stated, the Committee of Selection rejected what has undoubtedly become one of the greatest medical paintings of all time. Conjecture and recorded comments from the art critics of the newspapers suggest that exposure of the nude buttocks and an open inci-
Fig. 2. U.S. Post Hospital Building at Centennial Exhibition in Fairmount Park, Philadelphia (1876).

Fig. 3. Gross Clinic as a medical exhibit in U.S. Post Hospital.
sion on the bare thigh were offensive to the public; that the bloody hand and scalpel of the surgeon made people sick; that the painting was too dark; that some members of the Committee might have been jealous of a talent they could not emulate; or perhaps that Eakins was a victim of the New York establishment. Open hostility toward Eakins must be discounted, however, because five of his paintings, including the portrait of Professor Rand, were accepted and exhibited.

Considered at the time to be more a representation in the field of medicine rather than in art, The Gross Clinic was allowed to be hung in the United States Post Hospital Building (Fig. 2). It was exhibited on loan from Dr. Gross himself who was presiding over a medical convention in Philadelphia. The room was a prefabricated Army Post Hospital (Fig. 3) furnished with paper-mâché bed patients and photographic pathology exhibits on the walls.

The Alumni Association of Jefferson Medical College, founded by Dr. Gross in 1870, purchased the painting from Eakins for $200 in 1878 and presented it to the Board of Trustees the following year. The delay of three years must not be construed as indifference, for the alumni had been intensely solicited to direct their funds to the construction of the first Jefferson Medical College Hospital of 1877. Since its acquisition, The Gross Clinic has remained within the institution for which it was conceived and has become a priceless spiritual heritage jealously guarded by the alumni.

For twenty years (1878-98), the painting hung in the lower lecture room of the Medical College (Fig. 4), and for the next thirty years (1898-1928) in the basement reading room of the new College Building at the adjacent corner of Tenth and Walnut Streets. Its next home was in the Medical College Building of 1928 (Fig. 5) where it was destined to be admired by students and faculty for the next forty years (1929-69). Here it prominently occupied the center of a tall wall on the second floor lobby where it could also be seen from the street through a large windowed two-story archway.

Fig. 4. Lower lecture room of Jefferson Medical College (Ely Building) where the Gross Clinic hung from 1878 to 1898.
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After the initial impact of the painting on students was experienced, its daily viewing between classes led to its casual acceptance as part of the institutional decor. As Eakins became more and more recognized as an important artist, museums began increasingly to request a loan of *The Gross Clinic* for exhibit and tours. In 1961, the National Gallery of Art was organizing such a tour of Eakins' works and pointed out the urgent need for a conservation treatment of this particular one. This was carried out by the Philadelphia Museum of Art which renewed the decaying masterpiece.

In 1969, *The Gross Clinic* was moved into a new basic science building (Jefferson Alumni Hall) and displayed in a specially designed Eakins Lounge. By this time, increasingly substantial offers for its purchase had been refused and its vulnerability to theft or vandalism became a concern. Accordingly, it was placed behind a bullet-proof plastic shield with an alarm system. Unfortunately, this measure rendered the portrait impossible to appreciate because of reflected light (Fig. 6).

As offers for the portrait rose increasing well into the millions, the Connelly Foundation spearheaded a movement to assure its permanence within the institution by construction of an Eakins Gallery with *The Gross Clinic* as the center piece and the Eakins portraits of Professors Benjamin Howard Rand, and William Smith Forbes at either end (Fig. 7). A wrought iron entrance gate contributed by the Alumni Association was custom built by the world renowned Samuel Yellin Company (Fig. 8). The gallery, which opened in 1982, combined ideal viewing and security for the painting considered by many critics to be “the greatest masterpiece of American art.” In 1985, a diorama, approximately 12 inches square and set into the wall, depicted the portrait figures in three dimensions.

Eakins, the artist, sought vainly for recognition, faced many frustrations, and died in 1916 an unhappy man without children. Gross, the surgeon, in contrast, won increasing recognition, was rewarded with fame, and lived happily until 1884 with adoring children. Both, however, achieved immortality respectively in art and medicine.

Jefferson may justifiably be proud of its constantly improving physical face. On the other hand, visiting alumni frequently find their old haunts remodeled or altered in decor. The single landmark, however, which ignores the passage of time is *The Gross Clinic*. Indeed, it is not only the focal point of Jefferson’s splendid art collection but more importantly is an entrenched spiritual symbol.

It should come as no surprise that attempts have been made to poke good-natured fun by means of misrepresentation, so-called “spoofs”, of this great painting. One such appeared in the July 9, 1978, *Los Angeles Herald Examiner* by photographer Gus Gregory in which there was a reversal of the sexes. The face of Gross was replaced by a “foxy young blonde.” In place of the mother shrinking in horror he featured an elderly man. The women medical students were from North-

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In 1979, Dr. Wagner enlivened a talk at surgical grand rounds with a spoof of the Gross Clinic. The head of Gross was replaced by Francis E. Rosato (Chairman of the Surgery Department and Gross Professor), W. Joseph Hearn by Jay J. Jacoby (Chairman of Anesthesiology), Daniel Apple by Gordon F. Schwartz (Professor of Surgery), James M. Barton by Stanton N. Smullens (Clinical Professor of Surgery), Charles S. Briggs by Jerome J. Vernick (Clinical Professor of Surgery) and Franklin West, the registrar, by John V. Cattie (Resident in Surgery). This somewhat sacrilegious depiction was reproduced by the graduating students in their 1980 Yearbook (Fig. 10) and might have been appropriately tolerated by Dr. Gross himself who was never loathe to enjoy well-meaning fun.

References


Fig. 7. Gross Clinic in Eakins Gallery, opened in 1982, under main auspices of Connelly Foundation.
Fig. 8. Alumni gate to Eakins Gallery, built by Samuel Yellin Company.

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Fig. 9. Spoof of Gross Clinic with reversal of sexes.
Fig. 10. Spoof of Gross Clinic with faces replaced by 1979 staff members.
In 1895, the Jefferson Alumni Association, in conjunction with the American Surgical Association, raised sufficient funds to commission a bronze statue of heroic size of Professor Samuel D. Gross who died in 1884. Gross was the venerated Founder of both these organizations, the former in 1870 and the latter in 1880. Congress also made an appropriation for erection of the granite pedestal. The statue was a gift to the people of the United States and constituted the second ever erected in this country to a medical man. The first was to Dr. J. Marion Sims, the "Father of American Gynecology," unveiled in Bryant Park, New York City, in the Autumn of 1894. Sims was a Jefferson graduate in the Class of 1835 and is the subject of an account later in this chapter.

The sculptor was Alexander Stirling Calder, already distinguished for his figures in the fountain in Philadelphia's Logan Circle. He was the son of the sculptor of the William Penn Statue atop City Hall. The younger Calder copied the pose of Professor Gross from Thomas Eakins' *Gross Clinic*. It was eleven years after Gross' death, at which time the 25-year old sculptor was well on his way to a brilliant career. The bronze was cast in Paris.

The statue was erected in the Smithsonian Park in Washington, D.C. in the immediate vicinity of the Army Medical Museum (Fig. 1). It was unveiled on May 5, 1897, with a dedication address by Professor William Williams Keen, Jr. (JMC, 1862), who had succeeded to the Chair of Surgery in 1889. Jefferson Alumni attended the ceremony en masse, reserving a train to Washington for the occasion. They were joined by Fellows of the American Surgical Association and Friends. Keen's well prepared speech paid fitting tribute to the "Nestor of the Profession" and may be read in the *Transactions of the American Surgical Association* (1897).

A fortuitous concatenation of circumstances led to acquisition of the Gross Statue for the Centennial Celebration of the Jefferson Alumni Association in 1970. The statue had originally been located in Adams Drive to the rear of a building at Seventh and Independence Avenues, S.W. that housed the Army Medical Museum. The museum was started toward the end of the Civil War and the first Curator was John Hill Brinton (JMC, 1852). Later on, the museum became the National Library of Medicine. Eventually, that library was moved to Bethesda, Maryland, and in 1969 the Gross Statue was placed in storage.

It happened that Harold L. Stewart, Chief of the Laboratory of Surgical Pathology in the National Cancer Institute, a loyal Jefferson Alumnus (JMC, '26) and Washington, D.C. resident, alerted Norman J. Quinn (JMC, '48) about the statue. Dr. Quinn, who was the Centennial Committee Chairman, saw the situation as an opportunity to bring the statue to Jefferson where Gross had focused most of his professional life.

Dr. Quinn, along with John J. McKeown, Jr. (JMC, '47), contacted the Army Institute of Pathology with the view of acquiring the statue not only on long term, but most appropriately to mark the Centennial of the founding of the Alumni Association. They negotiated successfully with Colonel Frederick E. Moss, Legal Counsel for the Institute, and with Helen R. Purtle, Acting Curator of the Medical Museum. The signature of the Surgeon General authorized its transfer.

Following the Dean's Luncheon on Friday, May 1, 1970, the statue was presented to the University at its present location behind the Scott Library/Administration Building. At the ceremony, the Alumni Association was represented by its President, Paul J. Poirngrad (JMC, '41), the Medical School by Dean William F. Kellow, and the University by President Peter A. Herbut (Fig. 2).

The inscription on the pedestal of the statue pays fitting honor to Gross who brought lasting fame not only to his alma mater, but to American Medicine as a whole:
Fig. 1. Statue of Samuel D. Gross in the Smithsonian Park, Washington, D.C. Building in the background is the Army Medical Museum.
AMERICAN PHYSICIANS HAVE ERECTED THIS STATUE TO COMMEMORATE THE GREAT DEEDS OF A MAN WHO MADE SUCH AN IMPRESS UPON AMERICAN SURGERY THAT HE SERVED TO DIGNIFY AMERICAN MEDICINE
1897

Jefferson, through the University Art Committee, has provided for the maintenance of the patina of the statue against weathering and the soiling by birds. President Bluemle arranged for replacement of the scalpel which had been missing from the surgeon's right hand. Although not prized as highly as the Gross Clinic, the statue enhances the spiritual presence of its subject on the campus.

Fig. 2. Dedication of Gross Statue (behind Scott Building) at Centennial of Alumni Association (1970). Left to right: Dean William F. Kellow, President Peter A. Herbut, and Alumni President Paul J. Poinsard (JMC, '41).
The Cremation of Professor Samuel D. Gross

Samuel D. Gross died of congestive heart failure on May 6, 1884. A postmortem examination, performed by Jacob Mendes DaCosta (JMC, 1852), Professor of Medicine, revealed marked gastric inflammation, fatty heart, and a large cyst of the right kidney. Gross believed that cremation was the most sanitary way to dispose of the human body and accordingly preferred urn burial.

The burning of human corpses for disposal of the dead was widely practiced in the ancient world. Exceptions were in Egypt where the bodies were embalmed; in Judaea where they were buried in sepulchres; and in China where they were buried in the earth. Following cremation, the ashes were stored in urns, buried in the earth, thrown to the wind, or tossed at sea.

The practice of cremation in modern Europe was stopped by the doctrine of the Christian faith which believed in the resurrection of the body. As populations increased, the churchyards became overcrowded and made cemeteries necessary. Even cemeteries near inhabited houses sometimes provided insufficient space. The ultimate resort was a sanitary one, but was also accompanied by a modification in the concept of resurrection from a purely physical one to spiritual purification and redemption.

In 1874, an English society was formed to promote the practice of cremation. There were legal entanglements which delayed the first cremation which finally took place on March 26, 1885, in Woking, England.

The first recorded instance of cremation in the United States took place in 1792 when Henry Laurens, a Revolutionary statesman, stipulated in his will that his body “be wrapped in twelve yards of tow cloth and burnt until it is entirely consumed.” It was not until 1876, however, that the first crematory in the United States was erected in Washington, Pennsylvania, by Francis Julius Le Moyne, a physician and fearless outspoken abolitionist of slavery. The first cremation there was the body of a Bavarian nobleman, Baron Joseph Henry Louis Le Palm, who had come to the United States in 1862. Le Moyne, himself, who died October 14, 1879, at age 81, was cremated there. His ashes are buried under a tombstone in front of the building (Fig. 1). There were 42 cremations carried out there between 1876 and 1900. By the early 1950s, more than 190 crematoria were in use in the United States and Canada.

The Le Moyne Crematory is a national historical site which may be viewed inside by arrangement with the historical society of Washington, Pennsylvania. The right half of the building is a single office space where the paper work, records, and interviews with the family were conducted. The left half contains the incinerator with an independent door of access. This modest brick structure and its grounds are well maintained. Its location at the top of a hill and the pleasant houses surrounding it dispel morbid thoughts that might otherwise tend to occur.

The ashes of Samuel D. Gross were returned from the Le Moyne Crematory in 1884 and buried within an urn beside the coffin of his wife in Woodlands Cemetery, Philadelphia. The other members

Fig. 1. Le Moyne Crematory in Washington, Pennsylvania, where Gross was cremated in 1884.
of his family buried here did not desire cremation. A handsome tombstone, topped with a symbolic urn, marks the family lot and simply contains the name Gross (Fig. 2). A visit to this spot gives one the feeling of standing upon hallowed ground.

In more recent years, two other Jefferson surgical greats have chosen cremation, namely W.W. Keen (1932) and John H. Gibbon, Jr. (1973).

**NEWSPAPER, MAY 7, 1884**
**DR. GROSS TO BE CREMATED**
**The Funeral Services Last Night**
**The Body Sent To**
**Le Moyne Crematory**

"Funeral services over the remains of Dr. Samuel D. Gross were held at six o'clock last evening at the residence, corner of Eleventh and Walnut streets. The Reverend Dr. Curry, of Saint Luke's Episcopal Church, conducted the services. Outside of the immediate family there was no one present, except for Dr. Jacob Mendes DaCosta, who attended Dr. Gross during his illness and assisted at the autopsy yesterday morning.

"About half past eight o'clock, a hearse which had been in waiting at the Livery Stable a short distance below on Eleventh Street, drove up to the residence. A plain black casket was placed within it and it drove slowly up Eleventh Street, attended by four men who walked on either side of the vehicle. The body was taken to the workshop of the attending undertaker, Bringhurst, on Cuthbert Street a small thoroughfare below, and placed in a plain pine chest. The hearse continued then to the Broad Street Station, where the chest was forwarded to Pittsburgh on the Western Express, which left at 9:10 p.m. The body was placed in the forward baggage car and Charles Draper, the colored coachman, who has been in the employ of the family of Dr. Gross for a number of years, was directed to keep a last and lonely vigil on the mortal remains of his employer and benefactor. Accompanying the body were Dr. Phineas J. Horwitz, ex-surgeon General of the Navy; Benjamin Horwitz, of Baltimore, the son-in-law; and Councilman A. Haller Gross, the son of the deceased.

"The body of Dr. Gross was being quietly taken to Washington, Washington County, Pa., to be cremated in the Le Moyne Furnace in accordance with his expressed wish. He had long been a strong advocate of this mode of disposing of the dead.

"The authorities at the crematory had been notified, and as soon as Dr. Gross's body arrived there it will be committed to the retort. The ashes will probably arrive in this city on Saturday.

"An autopsy was made upon the body of Dr. Gross at his house yesterday morning by Drs. J. Ewing Mears, Jacob Mendes DaCosta, and Orville Horwitz. This was in accordance with the often expressed wish of the distinguished surgeon, who desired that his dead face should not be gazed upon and that the cause of his death should be ascertained beyond question. Death, it was found, was due to the sheer wearing out of the vital organs. No traces of disease were discovered, but life had ceased because there was no longer sufficient vitality to carry it on."

Fig. 2. Family gravesite of Samuel D. Gross in Woodlands Cemetery, Philadelphia.
Sims (Fig. 1) was born in Lancaster County, South Carolina, on January 25, 1813. He graduated from South Carolina College in 1832 and returned to Lancaster where he began to study medicine under the preceptorship of Dr. Churchill Jones. After a course of lectures at the Medical College of Charleston he came to Jefferson and graduated in 1835. He returned to Lancaster, but, on encountering a practice too slow, moved to Montgomery, Alabama. There he developed his reputation as a surgeon, operating successfully for strabismus, clubfoot, harelip and tumors of the jaw.

In 1845 Sims discovered the knee-chest position that bears his name and subsequently bent a kitchen spoon to invent the Sims speculum. Over the next five years he experimented with techniques to repair vesico-vaginal fistulae. Success was achieved when he resorted to the use of fine silver wire for suture material.

In 1853 Sims moved to New York where he purchased a large house in which he installed a private infirmary. He became obsessed with the ambition to establish a special hospital for the treatment of women’s diseases. After successful appeals to prominent citizens he was able to open the first Woman’s Hospital in 1855. It was the first such hospital of its kind in the world. Located at 83 Madison Avenue, near his home, and equipped with 40 beds, it served mostly indigent patients. The work flourished in quantity and quality, leading to a prestigious reputation for Sims.

In 1861 Sims took refuge in Europe with his family because of the Civil War which leveled ant-Southern sentiment against him. He became very prominent and successful in Paris, operating alike on the poor, the rich, and on royalty, including Empress Eugenie, wife of Napoleon III. In the Franco-Prussian War of 1870 he attended the wounded of both sides and received decorations from the governments of these countries. He was also decorated by the governments of Spain, Portugal, Belgium and Italy.

Meanwhile, in 1867 a new Woman’s Hospital was opened at Fiftieth Street and Fourth Avenue. Sims returned in 1868 to become the Chief Consulting Surgeon to the new Hospital, but continued to make periodic visits to his private practice in England, France and Germany. In 1874 Sims resigned from the Woman’s Hospital because the Board of Lady Managers would not allow more than 15 physician visitors at a time or admit women suffering from uterine cancer. In 1875/76 he served as President of the American Medical Association.

During the last year of his life, Sims prepared an autobiography entitled *The Story of My Life*. A most fascinating chapter deals with his student days at Jefferson which is retold in Chapter 2.

In his final year of 1883 Sims was planning to return to Rome to continue his successful practice there. While still in New York City and apparently in good health he was working in bed on his autobiography early in the morning of November 3. Suddenly seized by an attack of dyspnea, he called for his physician son, Dr. Harry Sims, who, on rushing to his father’s side, saw him die without uttering a further word.

**THE STATUE OF JAMES MARION SIMS: FIRST EVER ERECTED TO AN AMERICAN PHYSICIAN 1894**

Within a few weeks after the death of Dr. James Marion Sims (Fig. 1) on November 13, 1883, a suggestion was made through the *Medical Record* that a statue be erected in his memory. The fame of Sims was so widespread and the publicity so effective that a large Committee was assembled with members from New York City, Philadelphia, Boston, Chicago, Cincinnati, St. Louis, San Francisco, Augusta, Memphis, New Orleans, Tuscaloosa, Charleston, Richmond, Washington, and Balti-
more. The name of Gross from Philadelphia appeared on the Committee, but the elder Gross died in 1884 and the younger Gross in 1889, both well before the statue was finally erected in 1894. The Sims statue was the first ever to be erected in the United States in honor of a physician. The one to Samuel D. Gross in 1897 was the second.

Funds poured in from the profession in all parts of the country and abroad. Designs were obtained in competition by many artists. The commission was awarded to Muller of Munich whose work was completed for erection in Bryant Park, New York City, on October 20, 1894. Sims’ grandson unveiled the statue for presentation to the City of New York (Fig. 2).

Some of the salient remarks in the eulogy to Sims at the ceremony were as follows:

"In his own department Sims, a born and typical American, was a leading worker. He established a school of his own, which has now won fame throughout the world. Indeed, it is safe to say that Sims’ name is associated with more original operations and more new instruments for making such operations successful than that of any other American surgeon. His was the germinal thought implanted in a disposition for untiring work, which changed impossibilities into triumphs, restoring health and happiness to countless numbers of suffering womanhood.

"Thus while here, the statue preserves the memory of the good man, of the faithful worker, of the great inventor, of the broad philanthropist, the Woman’s Hospital becomes for him and all of us an ever-living principle, extending its charity, widening its influences, perfecting scientific skill, and fulfilling its divine mission of alleviating suffering and saving the lives of waiting generations of stricken womanhood.

"Among the many eminent physicians and surgeons whom America has produced, he stands preeminent as the man through whose genius, perseverance, and energy a special branch of medical science and practice was so renovated, improved, and elevated as to create an era in medicine and raise America from the place of the docile and receptive pupil to the proud position of the teacher.
of older nations.

"Without disparagement to the patient labors of previous workers in the same field, I (Dr. Paul F. Munde of New York City) must insist that the greatest triumphs in this specialty have been achieved since Sims first taught us how to use his speculum, the scissors, the knife, and the needle for the cure of the diseases to which he paid particular attention. J. Marion Sims may, therefore, with all propriety be called The Father of Modern Gynecology."

The inscription chronicled his career:

J. Marion Sims, M.D., LL.D.
Born in South Carolina, 1813. Died in New York City in 1883,
Surgeon and philanthropist.
Founder of the Woman's Hospital of the State of New York.
His brilliant achievements carried in the fame of American Surgery
Throughout the civilized world.
In recognition of his services in the cause of Science and mankind
He received the highest honors in the gift of His countrymen
And decorations from the governments of France, Portugal, Spain, Belgium and Italy.

On the reverse was inscribed:

Presented
To the City of New York
By
His professional friends and
Many admirers
Throughout the World.
Some of Jefferson’s professors had illustrious sons. One of George McClellan’s was a famous Civil War General. Samuel D. Gross fathered Samuel W. Gross, a distinguished surgeon and first husband of Lady Osler. William Henry Pancoast continued the tradition of his father, Joseph Pancoast, in anatomy and surgery. John H. Gibbon, Jr. invented the heart-lung machine and thus honored the professorship of his father, the senior John H. Gibbon. Another son, even more famous than his father, Professor John Kearsley Mitchell, was S. Weir Mitchell (Fig. 1).

Silas Weir Mitchell was born in Philadelphia on February 15, 1829, the third of nine children. Both his father and mother, Sarah Matilda Henry, were Virginians. The Mitchell household was one of refinement and culture. The elder Mitchell had a lifelong passion for poetry and counted Edgar Allan Poe and Oliver Wendell Holmes among his literary friends. Young Mitchell as a boy and youth showed little promise of what he was later in life regarded, - a genius. He was somewhat frail, bookish and inclined to be a private person. Like his father, however, he showed great interest in literature and was most fond of poetry. At age seventeen he published his first poem “To A Polar Star.” Many people were to encounter his name first as a novelist and discover later that he also was a prominent physician.

Although not an outstanding student, Weir showed an interest in his father’s chemistry lectures and laboratory. He entered the University of Pennsylvania at the age of fifteen where he was cited for poor behavior and poor scholarship. He also suffered from a lung ailment (tuberculosis?), which also afflicted his father.

At the end of three years of college, young Mitchell had to take leave (1847, at age 18) because his father’s illness (tuberculosis), fortunately of short duration, required him as the eldest living son to find an occupation that would provide for the family. According to Ernest Earnest in S. Weir Mitchell: Novelist and Physician, Weir “welcomed the break as an escape from mathematics which he hated.” He thought of entering a chemical factory, but his father objected on the grounds that an investment would be required. A relative of his mother offered him a partnership in a firm in Lancaster, England, with the promise that Weir would ultimately inherit the business. Although the offer was accepted, the cousin went down with the Lexington two weeks later. Mitchell thus escaped a business career for which he had no inclination.

Further, according to Earnest, the elder Mitchell objected to his son’s desire to study medicine with the tirade: “You have no appreciation of the life. You are wanting in nearly all the qualities that go to make a success in medicine. You have brains, but no industry.”

Weir graduated from Jefferson in 1850 in a class of 211. His graduation thesis was on the “Intestinal Gases.” The “Famous Faculty of 1841” was attracting large classes comparable to those of today.

In accord with the standards of the time for an

Fig. 1. Silas Weir Mitchell, M.D., LL.D. (JMC, 1850), noted neuropsychiatrist and novelist.
elite education in medicine, young Mitchell took off to Europe for a year of study at the important clinical and research centers. He was greatly influenced by Claude Bernard in Paris.

On return to Philadelphia he entered into practice with his father at the southwest corner of Eleventh and Walnut Streets and remained in practice until the time of the Civil War.

The elder Mitchell died in April, 1858, and in September Weir married Mary Middleton Elwyn. Their first son was born the following year and another in 1862. In that year his wife died of diphtheria, and it was not until 1874 that he married Mary Cadwalader, a member of the socially prominent Philadelphia family.

In the several years before the Civil War, Mitchell conducted experiments in physiology, pharmacology and toxicology that established him as a scientist. His most important publication during this time (1860) was a monograph on "Researches Upon the Venom of the Rattlesnake" which eventually consisted of ten papers.

During the Civil War Mitchell initially secured a part-time commission as a "contract surgeon" at the Filbert Street Hospital in Philadelphia, which he described in his novel, In War Time. In 1863 the Surgeon General, Dr. William Alexander Hammond, himself a neurologist friend of Mitchell acquainted with his researches, assigned him to a special hospital of 400 beds (Turner’s Lane) to investigate injuries to the nervous system. There with two other Jefferson colleagues, his classmate George R. Morehouse (JMC, 1850) and W.W. Keen (JMC, 1862), he developed that hospital into the foremost center of research on nerve injuries. They published Gunshot Wounds and Other Injuries of Nerves (1864) and Injuries to Nerves and Their Consequences (1872).

It is important to stress that during the 1860s Mitchell had high ambitions of obtaining an academic chair in either of his alma maters – the University of Pennsylvania or Jefferson. His first disappointment came in 1863 when Samuel Jackson resigned the Chair of the Institutes of Medicine in the University and the appointment was awarded to Francis Gurney Smith. His friend, Surgeon General Hammond, referring in disgust to what he considered vile politics on the Board in the appointment, wrote in an attempt at consolation: “It is an honor to be rejected by such a set of apes.” Louis Agassiz, the world renowned natural scientist, also wrote to Mitchell that his rejection “resulted from prejudice in American education circles against men who placed scientific research ahead of facility in teaching. Successful candidates for chairs are usually men of fluent speech who gained their knowledge from reading rather than from independent investigation” (quoted from Two Centuries of Medicine by George W. Corner, Lippincott Co., 1965).

When Robley Dunglison resigned as Professor of the Institutes of Medicine and Medical Jurisprudence at Jefferson in 1868, there was open competition for this chair between Mitchell and James Aitken Meigs (JMC, 1851). They were both 39 years of age and had both graduated from Jefferson Medical College within one year of each other. In the light of what we know today, both the University and Jefferson missed their opportunity to appoint the man who has been called “the most versatile American since Franklin”, “Philadelphia’s Lost Physiologist,” and acknowledged by many as a genius. Meigs, who had acquired an international reputation as an ethnologist, received letters of support from Professor Joseph Henry of the Smithsonian Institution, Dr. Josiah Clark Nott, a noted ethnologist from Alabama, Professor Wilson from Toronto, Professor Richard Owen of the British Museum, Professor William Turner of the University of Edinburgh, Dr. Paul Broca of the Academy of Medicine in Paris, and the scholars Von Duben of Stockholm and Pruner Bey of Cairo. Meigs proved worthy of the appointment but died at the premature age of 50 and is mainly remembered today by the Meigs Medical Association, in continual existence since 1880. Mitchell, on the other hand, lived to be 85 as one of the most broadly based intellectuals of his day, a founder of American neurology, a gifted researcher, poet and novelist.

In 1876 the University of Pennsylvania did elect him to its Board of Trustees on which he served for 35 years. In 1880 Mitchell was a candidate for
the Provostship at the University upon the resignation of Charles J. Stille, but the post was awarded to the second William Pepper. Later in his career he was elected Professor at the Philadelphia Polyclinic and College of Graduates in Medicine, where he was regarded as an inspiring lecturer. He was a founder of the Pathological Society of Philadelphia and a member of the American Philosophical Society by the age of 33. He was a physician to the Southern Hospital, St. Joseph's Hospital, the Pennsylvania Institute for the Instruction of the Blind, Presbyterian Hospital, the Orthopaedic Hospital and Infirmary for Nervous Diseases where he collaborated with William Osler, State Lying-in Hospital and Infirmary, and the Insane Department of the Philadelphia (General) Hospital. He served as President of the College of Physicians of Philadelphia for two terms (1886-88 and 1892-94).

Mitchell pioneered in the description and treatment of nervous disorders such as reflex paralysis, erythromelalgia, diseases of the cerebellum, neuralgia, locomotor ataxia, headache, facial tic, spastic paralysis, trophic disorders and neurologic complications of amputations such as "phantom limb." Mitchell was willing to treat the neurotic and mentally ill who were being ignored by neuropsychiatrists of the day who confined their efforts to those in asylums. Some of his success may be credited to two books written for the lay public. Wear and Tear, or Hints for the Overworked (1871) and Fat and Blood: An Essay on the Treatment of Certain Forms of Neurasthenia and Hysteria (1877) were widely read. His popularized "rest cure" included bed rest, isolation, massage, and a rich diet including extra amounts of milk. The story is told that when Mitchell's own nerves gave way he rushed to Europe and consulted a Viennese specialist. He was told: "In your own country is the man who can do you the most good. His name is S. Weir Mitchell of Philadelphia."

Another and probably more accurate version of this anecdote is narrated by J. Madison Taylor in his "Personal Glimpses of S. Weir Mitchell" in Annals of Medical History, Sept. 1929, p. 587. "One incident he often cited with glee. When a young man he was suffering from some ailment and, being in Paris, he consulted the great Charcot, who asked suddenly: 'Do I understand you come from Philadelphia?' 'Yes.' 'That is fortunate,' said Charcot. Then he turned to his desk and started to write, calling back: 'I am writing to a friend of mine, a most remarkable physician and I am going to put you under his care. I am offering him some opinions and recommendations.' 'Will you tell me to whom of my rivals, you are referring me?' 'Yes, to Dr. S. Weir Mitchell,' 'Oh,' said Dr. Mitchell, 'I am he.' 'Oh', said Charcot, 'then you will not need this letter.' And he tore it up. Dr. Mitchell declared that he never ceased to regret that he failed to secure and keep that letter to himself about himself."

Mitchell was reputed to have remarkable eyesight. This was attributed to the fact that one eye was far sighted and the other near sighted. For distance he used the far one and excluded the near

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one. For close work he reversed the process. This apparently afforded him a wide range of vision. He never had to wear glasses. He considered this trait a blessing from the Almighty. This arrangement of vision does not offer the same advantages to all humans. One of Mitchell's patients with one short and the other long distance type of vision suffered from eye pain and headaches. It annoyed Mitchell that a refraction correction was required for relief.

Mitchell's name was acclaimed as much by the lay public as by the medical profession. This was because of his literary output as a novelist, short story writer, and poet. It is interesting that he did not start publishing his novels until the age of 52. For many years he was famous as the author of *Hugh Wyne* (1896), a tale of the Revolutionary War written when he was 67 (Fig. 2). It eventually sold over five hundred thousand copies. Two other successful war background novels were his *Constance Trescott*, published when he was 76 and *Westways* at 84. Among his 19 novels may also be mentioned *Circumstance, Dr. North and His Friends, In War Time, and Hephzibah Guinness* as notable.

Mitchell's experiences and impressions from his psychiatric work were interwoven in these books in which portrayals of pathologic personalities made fascinating characters. His literary output also included many short stories, children's stories, and nearly 150 poems. He composed verses until the very end of his life, at which time *Barabas* was written. His *Ode on a Lycian Tomb* (1898), one of his best poems, was written after the death of his daughter.

Mitchell was very friendly with William Osler and W.W. Keen. These three men were influential in building up the library of the College of Physicians of Philadelphia to a stature of national prominence. Mitchell found much in common with Oliver Wendell Holmes, Professor of Anatomy at Dartmouth and later the Parkman Professor of Anatomy and Physiology at Harvard Medical School. In 1892 Mitchell made a poetic tribute to Holmes on the occasion of the presentation of Sarah W. Whitman's Portrait of Holmes to the College of Physicians. This portrait now hangs in the Cadwalader Room. Not to be outdone, Mitchell Hall in the College contains portraits of Mitchell by Franz Dvorak and Robert Vonnoh, a marble bust by William Partridge and a bronze

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Fig. 3. Funeral of S. Weir Mitchell from St. Stephen's Church (January 6, 1914).
relief by Otto Schweitzer.

Mitchell received honorary degrees from Harvard, Princeton, Jefferson, Toronto, Bologna and Edinburgh Universities, in addition to honorary membership in many foreign scientific societies.

Dr. Mitchell’s last home was at 1524 Walnut Street where he lived from 1873 until his death from pneumonia on January 4, 1914. The building was demolished to make way for the Integrity Trust Company. A white marble plaque is affixed to the Walnut Street wall, marking the site of Dr. Mitchell’s residence. Another physical testimony still exists in the Franklin Club which was organized under his guiding spirit in 1902. The house is at the corner of Camac and St. James Streets. It was planned to bring authors, illustrators, and publishers of Philadelphia into closer contact. He was its president from its founding until his death.

The funeral of Dr. Mitchell took place on January 6, 1914, after impressive ceremonies at St. Stephen’s Episcopal Church, 19 South 10th Street, in Philadelphia, a site at which Benjamin Franklin is reputed to have flown the kite that drew lightning from the sky (Fig. 3). He was buried in Woodlands Cemetery, Philadelphia, and shares a tombstone with his father, Professor John Kearsley Mitchell (Fig. 4).

Jefferson may proudly claim S. Weir Mitchell as one of its most illustrious sons, and, in the light of history, lament his loss as the most worthy of the eligible successors to Robley Dunglison. In 1975 he was chosen as one of the five Jefferson Alumni to be included among 50 great medical benefactors whose names were honored on the Winged Ox Column.

**Fig. 4. Tombstone of S. Weir Mitchell in Woodlands Cemetery, Philadelphia.**

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**Juan Carlos Finlay (JMC, 1855): Discovered the Mosquito of Yellow Fever**

“The confirmation of Dr. Finlay’s doctrine is the greatest step forward made in medical science since Jenner’s discovery of the vaccination.”

These were the words of General Leonard Wood, a physician and military governor of Cuba on December 22, 1900, at a banquet in honor of Carlos Finlay. Present were Reed, Carroll, Agramonte, Gorgas, Guiteras, Albertini and more than 60 other American and Cuban physicians who were paying homage to the man who had described the mosquito which transmitted yellow fever from an infected to a well person. Scientific organizations and the world press were represented in this tribute. Dr. Dominguez, Dean of the Faculty of Medicine in Havana, presented to Finlay in the name of his admirers a bronze statuette by Barbedienne entitled The Thought. After giving credit to his collaborator, Dr. Delgado, and to Dr. Reed, Chairman of the U.S. Army Board, Finlay modestly concluded: “Thank you my friends.”

Major William Crawford Gorgas, a career U.S. Army physician, was appointed in charge of the health of Havana in December, 1898. In February, 1901, he was given the order to clear the city of the Stegomyia fasciata (Aedes aegypti) mosquitoes singled out by Finlay and proven by the Reed Commission as the carrier of yellow fever. In implementing the prophylactic measures long advocated...
by Finlay, Gorgas sent out "Stegomyia" brigades to destroy all water deposits where the mosquitoes could lay their eggs and to pour oil on stagnant ditches. Six months later the last case of yellow fever was recorded in Havana. This was Finlay's greatest triumph. His work made possible the American completion of the Panama Canal and saved millions of lives throughout South America, the Caribbean, Africa, and the southern United States. As an honoree on Jefferson's Winged Ox Column, the career of this glorious alumnus and giant in medical history is worthy of recount.

Juan Carlos Finlay (Fig. 1) was born in Camaguey, Cuba, on December 3, 1833, the son of Dr. Edward Finlay, a Scottish physician, and a French gentlewoman, Eliza de Barres, from Trinidad. After being tutored at home, young Finlay at the age of eleven was sent to France for his secondary education. His studies were interrupted there by political disturbances which compelled him to continue for a year in Germany. An attack of rheumatic fever complicated by chorea then forced his temporary return to Cuba. On his return to France he rounded out a solid foundation in the classics, mathematics, chemistry, physics, geography, and history. He intended to study medicine in France but once more had to return to Cuba, this time to recover from an attack of typhoid fever. His decision to study medicine at the University of Havana was thwarted by refusal of the administration to accept him because his preliminary education had not been received there. His father then advised him that there was an excellent medical college in Philadelphia that would take him, namely Jefferson Medical College. This young institution was by then outstanding because of its "Famous Faculty of 1841" which included: Joseph Pancoast, the renowned anatomist/surgeon; Franklin Bache, the great-grandson of Benjamin Franklin and Professor of Chemistry; Robley Dunglison, the "walking dictionary," Professor of Institutes of Medicine (Physiology); Charles Delucena Meigs, a brilliant lecturer in Obstetrics; Thomas Dent Mutter, a francophile surgeon who had imported the "quiz" system from Edinburgh; Robert M. Huston, the popular Professor of Materia Medica and Therapeutics; and John Kearsely Mitchell, the Professor of Medicine whose theories on epidemics were permanently to influence the rest of Finlay's life. He registered at Jefferson in 1853 as Charles Finlay and graduated in 1855.

Finlay's preceptor at Jefferson was Silas Weir Mitchell, the son of Professor J.K. Mitchell, a man only four years his senior and himself an 1850 Jefferson Alumnus.

Finlay stayed with the younger Mitchell for a year after graduation in order to complete the three years of preceptorship required for the M.D. degree. Weir Mitchell had done work in Paris in the laboratory of Claude Bernard, where he had acquired proper habits of scientific investigation that were able to inspire Finlay. When the latter left Philadelphia, Mitchell saw to it that he took with him the best available binocular microscope, as well as a curiosity about the causes of epidemic fevers. Mitchell was to remain his advisor and friend for life. They ultimately died within a year of each other, - Mitchell in 1914 at age 85 and Finlay in 1915 at age 82.

In 1856 Finlay began a series of travels, which included a period in Paris of postgraduate study in opthalmology.

He began permanently to practice medicine in Havana in 1864. Despite his busy practice, he always found time to use his microscope in special...
investigations. Even when he first arrived for medical study in 1853, there occurred an outbreak of yellow fever in Philadelphia. It was endemic in his own country. In 1858 he conducted an extensive study of the variable alkalinity of the air which he thought might relate to the variable occurrence of yellow fever in Havana. He also wrote articles on cholera, leprosy, relapsing fever, beriberi, filariasis, and trichinosis. In 1879 the Spanish Governor of Cuba appointed Finlay, as a representative, to collaborate with members of an American Yellow Fever Commission (not to be confused with the later Reed Commission of 1900) which was sent to Havana for studies of this disease. The report of the Commission on its return to the United States included an account of Finlay's investigations on the alkalinity of the air. It concluded that yellow fever was a transmissible disease for which the causative agent should be found in the air. The Commission gave Finlay numerous specimens of blood smears and histologic slides of blood vessels for his further study. In the authoritative article by Juan A. Del Regato, M.D. in the Jefferson Medical College Alumni Bulletin for Summer, 1971, entitled Carlos Finlay and the Carrier of Death, Rudolph Matas, a junior member of the U.S. Commission and later pioneer in vascular surgery, is quoted as saying: "...the image of Carlos Finlay remained in my mind as the model of exemplary wisdom, of the laborious worker, wealthy in strength of knowledge, in rectitude of principles, in conscientiousness and intellectual integrity". Between 1865 and 1881 Finlay wrote ten papers on yellow fever.

Finlay became convinced that the behavior and frequency of mosquitoes related to the occurrence of yellow fever. He noted that during hot weather it developed at low altitudes; that cases decreased with higher altitudes and fewer mosquitoes. He designed experiments in the attempt to prove that by mosquito inoculation he could produce a mild type of disease that would confer immunity. Unfortunately, this line of investigation failed. On February 18, 1881, at the International Sanitation Conference in Washington, D.C., he proposed three conditions necessary for propagation of yellow fever: (1) existence of a previous case; (2) a person capable of developing the disease; (3) an agent for its transmission. He pointed out six months later that the Aedes aegypti mosquito was the transmitting agent. It would take about twenty more years before the Reed Commission would prove the accuracy of his hypothesis.

In August, 1900, Dr. Jesse W. Lazear, a graduate of Columbia University (1892) who had received training in Berlin and the Pasteur Institute of Paris, conducted experiments as a member of the Reed Commission in a station near Havana, in which he applied infected mosquitoes to nine American soldiers as well as the Commission members themselves (in order to avoid criticism). Although the first experiment failed, Lazear tried again two days later and also inoculated Dr. James Carroll with an infected mosquito. Carroll, as well as a soldier, developed yellow fever. Lazear himself, after being bitten by an infected mosquito, died of the disease. The ova of the correct species of mosquito had been supplied by Finlay. The benefit from this conclusive knowledge would prove global.

One might well wonder as to what flash of intellect could have led Finlay to his persistent belief in the mosquito transmission of yellow fever. Was it from experiment, pure logic, serendipity, clairvoyance or some combination of all? Dr. Juan A. Del Regato offers this explanation in the Alumni Bulletin article already referred to (Summer, 1971): "Finlay, a man of varied interests, was reading a book of botany by van Tieghem. He was attracted by the description of the evolutionary cycle of a parasite of wheat (Puccinia graminis) whose spores of the fungus were said to be unable to germinate except on another plant (Berberis vulgaris) whose presence was necessary for the parasite to complete its cycle and destroy wheat. Thus, Finlay was led to think of an equally indispensable intermediary between one case of yellow fever and the next. As he sat beside his bed saying his rosary one night, Finlay was disturbed by a persistent mosquito. Distracted from his devotions, his mind starting the cycle of scientific discovery, first conceived an idea that had never as yet occurred to any man: that the mosquito could be that indispensable in-

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termediary, the carrier, a veritable vector of death between the sick and the next victim. And, once again, as in numerous other instances of important human discoveries, the genesis was not the result of logical conclusion or the yield of an experiment, but rather of a sudden thought, as a flash of light in the darkness: a sudden illumination, a manifest sign of long prior cogitation."

On October 23, 1900, Dr. Walter Reed presented a paper entitled *The Etiology of Yellow Fever, A Preliminary Note* at the meeting of the American Public Health Association in Indianapolis. He stated authoritatively that the mosquito "serves as the intermediate host for the parasite of yellow fever." Included among the details of the work by his Commission, Reed stated this about Finlay: "We have no space to refer, at length, to various interesting and valuable contributions made by Finlay to the mosquito theory for the propagation of yellow fever...we here desire to express our sincere thanks to Dr. Finlay, who accorded us a most courteous interview and had gladly placed at our disposal his several publications relating to yellow fever during the past nineteen years; and also for ova of the variety of mosquitoes with which he had made his several inoculations."

Finlay did not rest on his laurels. He became the first Director of Health of the Republic of Cuba on May 20, 1902, a position in which he gave seven years of devoted service before retiring at the age of 76. His Alma Mater, Jefferson Medical College, awarded him an honorary degree of Doctor of Science (1902) and the Liverpool School of Tropical Medicine honored him with its Mary Kinsley Medal. He was nominated for the Nobel Prize in Physiology or Medicine in the years 1905, ’06 and ’07 as well as 1912, ’13, ’14 and ’15, the latter being the year of his death. He was a serious contender on all of these occasions but "the numerous contemporary claims" and other indeterminate considerations failed to render him justice.

Finlay's honors were not confined to his lifetime.
His statue in marble was erected in front of the Ministry of Health of Cuba, surrounded by the bronze busts of other yellow fever pioneers, - Lazear, Gorgas, Delgado and Giuteras. In 1927 the Gran Canciller, Order of Merit of Carlos Finlay, was dedicated in 1921 by the Cuban government for recognition of outstanding contributors to the field of health. In 1927 the Instituto Finlay of Havana for research in tropical medicine and preventive medicine was dedicated. The Republic of Cuba issued two denominations of Finlay stamps in 1933, the centenary of his birth (Fig. 2). In the same year the Academy of Medicine of Paris also celebrated his 100th birthday and in 1934 named one of its streets in his memory (Rue du Docteur Finlay).

The Colegio Medico of Cuba proclaimed December 3rd, his birthday, as “Dia del Medico” (Physicians’ Day), which for years was chosen as an occasion to extend respects to practitioners of medicine. This Day in 1952 was selected for the dedication of Park Lazear, to the memory of those who played a part in the experiments carried out to test the validity of the mosquito theory of transmission of yellow fever. The Park is located in Finca, San Jose, Reparto, Pagolotti, Marianao, just outside Havana. It was named after Dr. Lazear of the Walter Reed Commission, who died in the experiments. Jefferson Medical College was officially invited to send a representative to the dedication for which Dr. Leandro M. Tocantins was appointed by Dean George Bennett. The ceremony took place at a curved stone wall in which were inserted the medallions (Fig. 3) of those who had participated in the yellow fever experiments (Dr. Finlay in the center and Drs. Delgado, Wood, Reed, Lazear, Carroll, and Agramonte). Dr. Tocantins placed a floral wreath beneath Finlay’s medallion (Fig. 4) and took his turn in delivery of a short eulogy in Spanish.

In 1955 Jefferson Medical College held meetings in commemoration of the Centenary of his graduation. On September 23rd a symposium on yellow fever was held before a large audience in McClellan Hall. There were distinguished speakers from Cuba, Canada, the U.S. (New York City and Washington, D.C.), India, Brazil, Colombia, and Trinidad. That evening a Biographical Sym-
Carlos Finlay and S. Weir Mitchell: Relationship of Two Illustrious Jefferson Graduates

by Leandro M. Tocantins (JMC, 26)

In 1829 a child was born in Philadelphia who was destined to bring honor and to give service to his native city and his country. His name was S. Weir Mitchell. Four years later, and thousands of miles away, another child was born in Havana, Cuba, who was also destined to bring honor and give service to his native country and to humanity. His name was Carlos Finlay.

Very early in their young manhood these two men met, and their meeting resulted eventually, during a life-long friendship, in "joining forces", as it were, in one of the most important and valuable discoveries in medical history. They kept in touch all through their lives, sought advice from each other, and their deaths were only one year apart.

The background of both Finlay and Mitchell had many similarities. Both were sons of doctors of medicine, and interest in medical science seemed to be part of the heritage of each one. Weir Mitchell's father, John Kearsley Mitchell a Scotsman, was a physician in Philadelphia and a pro-
fessor of medicine at Jefferson Medical College. Carlos Finlay's father, also a Scotsman, was a physician in Havana, Cuba.

Approximately two years after his graduation from Jefferson Medical College, Weir Mitchell returned to Philadelphia from Europe where he had augmented his medical education with studies under the foremost men of that time. He had spent much of his time with Robin who was the leading clinical microscopist of his day, and attended lectures given by Claude Bernard in the Palais de France. Bernard’s influence was very strong upon the young doctor and probably influenced his great interest in experimental demonstration.

It was at this time that he met Charles Finlay, who had come from Havana the year before and registered at Jefferson College in 1853. It was then that a communion of interests was discovered, and Finlay chose Mitchell for his preceptor. He was in reality Weir Mitchell’s first pupil. After Finlay's graduation in 1855, he spent another year with Mitchell who was so strongly impressed with the talent of his pupil that he tried to persuade him to remain in the United States. Finlay, however, decided to return to Havana.

Finlay's decision was perhaps influenced by John Kearsley Mitchell, in an indirect way. John Mitchell was far ahead of his time and a distinguished authority on infectious diseases of his day. That may have been one of the factors in Finlay's decision to come to Jefferson College in the first place. Finlay had a great sense of responsibility to his own country and realized the many questions which challenged doctors in Cuba. John Kearsley Mitchell published a monograph advancing a theory which, at that time, was far advanced over the theories of his contemporaries. He believed that the so-called infections of contagious diseases were caused by microorganisms. Working and studying under this man must have contributed much to Finlay's later experimental research.

Finlay, then, returned to Havana and began to practice and, unfortunately, for the next twenty-five to thirty years we have not been able to find any documentary evidence of communication between S. Weir Mitchell and his former pupil. The first indication that there was a close contact maintained between these two men is a publication in the American Journal of Medical Sciences, which was then edited by I. Minis Hays and, incidentally, was referred to at the time as The International; in fact, one of Mitchell’s letters refers to the American Journal of Medical Sciences as The International Journal. The reason for this is that the Journal was edited both from Philadelphia by Minis Hays and from London by Malcolm Morris, and it is called The International Journal of Medical Sciences. It was published by Lea Brothers & Co., and the successors of this firm are still the publishers of the Journal. This particular volume is the volume of 1886, and it carries an article on yellow fever entitled: “Yellow Fever: Its Transmission by Means of the Culex Mosquito” by Charles Finlay. And, harking back to John Kearsley Mitchell for a moment, at one time in analyzing the transmission of various diseases he said that yellow fever, from its known characteristics, might be considered to be “not contagious but portable”. In the light of Finlay’s later research and development, this statement is significant evidence of John Kearsley Mitchell’s advanced thinking.

In the above mentioned article, Carlos Finlay says, “in searching for a natural agent capable of fulfilling this condition I was led to fix upon the Culex mosquito as the most likely one”.

In a letter from Weir Mitchell to Carlos Finlay, dated September 23, 1887, there is a strong indication that Mitchell had much to do with the publishing of this article. It would seem that having heard from Finlay of his experiments with yellow fever, Mitchell wrote this letter in reply. The letter reads: “My dear friend: This is glorious indeed! I wish you would at once write a condensed paper with enough of new to justify its reading. I will read it to the College of Physicians and have it published at once. What Welch (this, of course, is William Welch, famous bacteriologist and pathologist) may say can follow. The new cultures I will send to Osler (Sir William Osler, Professor of Medicine at the University of Pennsylvania) and my son for study.” (His son, John Kearsley Mitchell was also a famous physician). “Your paper should
be about ten pages or so and resume all your work to the present time. It will at once go into the News.” (The News was one of the prominent medical publications of the time.)

This was in 1887, when the controversy was raging about the etiology of yellow fever. However, this whole matter refers to one of those mistakes which are made by every scientist who eventually accomplishes anything. One cannot judge the worth or stature of an investigator by his errors, but by what his errors have taught him in achieving final accomplishment. The error made by Finlay was in thinking that certain tetragenous microorganisms were the cause of yellow fever, and he was sending these cultures and his paper to Mitchell with the hope that Mitchell would give it great dissemination.

Weir Mitchell fulfilled the promise to his friend and brought the question of transmission of yellow fever before the College of Physicians. In The Transactions and Studies of the College of Physicians in 1887 we find the following “Remarks in Regard to Dr. Finlay’s Researches with Reference to the Bacillus of Yellow Fever” by S. Weir Mitchell. “Dr. Finlay, of Havana, has been studying yellow fever, and believes that he has made a series of valuable discoveries. He has sent me some of the cultures which represent the bacteriological forms he has found. Some of these I sent to Dr. William Welch, of Baltimore and some to Dr. William Osler of this city. Dr. Finlay suspected that the mosquito was the agent in certain cases in the transfer of the poison of yellow fever from one person to another. He has made a series of experiments on this subject which were set forth in a paper published in the American Journal of the Medical Sciences of two years ago. He has finally, as he believes, succeeded, by placing the mosquitoes on the skin of a man affected with a severe form of the disease and then transferring them to persons who never had the disease, in giving the latter a mild form of the disease. I believe that Dr. Finlay proposes to present a paper to the College, giving the discoveries which he has made and the proof which supports them.” The account goes on; “Dr. Dock exhibited the cultures referred to above. He first read from a letter from Dr. Finlay in which the writer stated that he had proven the transmissibility of yellow fever through the bite of the mosquito; that he had demonstrated a specific tetragenous microbe in the blood, in the serum of blisters, and in the skin; and that he had obtained this same microbe in mild cases of yellow fever, developed to all appearances from mosquito inoculation.”

This was partly responsible for shaking some of the confidence in Finlay’s early work with the vector of yellow fever, because at the time it was almost fashionable for organisms, microorganisms, to be discovered from various portions of the world. Sanarelli had one, Freire had another, Mexican workers had still another organism and Dr. Finlay had the one we have just mentioned. Dr. George Sternberg, who was a very distinguished bacteriologist of the day, spent a good deal of his lifetime tracking down these supposed causes of yellow fever and showing that they did not have anything to do with the cause of the disease.

In a letter which was presumably written about August, 1890, Mitchell writes to Finlay, following up the same matter: “I sent your photographs and papers, etc., to my friend Professor Welch, Johns Hopkins University, Baltimore. I told him you would send him cultures and asked him as a favor to me to study the matter with care and to report on it in print. No one is more competent.” (This is definite evidence that the Preceptor, Mitchell, was still sponsoring and applauding the work of the pupil, Finlay) “This seems to me better than to send it to the International, which will be a poor affair and, of course, accepts only unpublished papers. I presume yours to be in print, you do not say where or when. It seems to me a very important discovery. Dr. Sternberg, sent by our government to South America, is now studying Yellow Fever. A note from you to him, would reach him and perhaps induce him to go to Cuba on his way home.” (Sternberg was in South America tracking down the organism which had been described by Freire, a Brazilian bacteriologist as the cause of the disease. This was subsequently proven not to have anything to do with yellow fever.)

A further note from Dr. Mitchell on September
4th says briefly: "Dr. Sternberg has returned. You had best write to him at Johns Hopkins University. Also, were I in your place, I'd ask Welch's advice as to any further step."

And now we come to one of those puzzling lapses in the correspondence of these two men just at the time when it would be most interesting. In one letter Mitchell says, "I enclose Welch's note," but no note has been found. It would be most interesting to know what a man like William Welch would have to say about Finlay and his contribution at this time. But we know that Sternberg did go to Cuba. Was it the result of intercession on Mitchell's part? We could very well believe this when we read Mitchell's address as President of The College of Physicians. In it we find these words: "I am glad to say that the decision of the Government as to sending commissions to study cholera and yellow fever owed much to the influence which, as your President, I was able to exert with the Department of State." Here we have very clear evidence that Weir Mitchell was interceding actively in trying to bring about what he thought would be further investigation into a subject which was very dear to his heart, since it was initiated and furthered by his pupil, Finlay.

In 1888, while Weir Mitchell was President of The College of Physicians, one of the leading medical journals printed a paper which had been delivered before the College by George Sternberg. This paper had to do with "Investigations Relating to the Etiology and Prophylaxis of Yellow Fever." Dr. Sternberg analyzes very thoroughly and very easily the contributions that had been made up to that time regarding the etiology of yellow fever, and many felt that he was a little too critical of the work which had been done by Finlay. He devoted only a few lines to Finlay's experiments concerning mosquito transmission and those few lines were not laudatory. The rest of the paper was of excellent caliber because subsequent knowledge has fully justified that stand of Sternberg's, which was that as far as he could determine, none of these things which were supposed to be the cause of yellow fever had been proven.

This paper aroused Finlay. Hurt and indignant he wrote to Weir Mitchell about it. We do not have Finlay's note, but we do have the letter Mitchell wrote in reply: "My dear Finlay: Your letter arrived this Christmas morning and I make haste to say a few words in reply. I have not yet seen the back numbers of the Journal, but I have the greatest confidence in your powers of observation, and neither Sternberg nor anybody else will really shake it or make me believe that you are wrong in a matter of observation until you, yourself, tell me so. I believe that you will come out all right and satisfy everybody, including Sternberg, who is a man of fair mind. Kind Christmas regards to you and yours from, Your old and attached friend, S. Weir Mitchell."

This letter surely gives strong proof that Weir Mitchell not only had absolute faith in the skill and integrity of his pupil, but unconsciously perhaps, and then again it may have been with full confidence in his words, he prophesied what actually came to pass, Sternberg's admission eventually, that Finlay's theory of the transmission of yellow fever was correct.

There must have been more correspondence between these two friends after the above letter. In 1902 Finlay was honored by the College of Physicians and it was Weir Mitchell who proposed him. There were surely letters written at that time, but as far as we can determine they do not exist now. Only one last letter has been found, from Mitchell to Finlay (and we know it is in reply to one from Finlay, although we cannot find that letter). It reads: "My dear old well remembered friend: Thanks for the kindly thought of me. It was but a few days ago I was talking of you. Now we are both well or ill, on in years, and have seen more things than Ulysses. I hope, my friend, that you are as well as I could desire. God Bless you, Weir Mitchell."

This is the last remaining written evidence of the strong attachment and friendship between these two illustrious graduates of Jefferson College. They formed an intellectual partnership which indeed bore fruit; Charles Finlay in the experimental groundwork of discovering the transmission of yellow fever, and Mitchell in the encouragement

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of Finlay and in giving it to the medical world as effectively as possible in both the published and the spoken word. Neither were seeking personal applause and time has vindicated Mitchell’s faith in Finlay and his unfailling support.


Among the surgical giants in the history of Jefferson, John H. Gibbon, Jr. stands as an equal in the company of George McClellan, Samuel D. Gross, William W. Keen, Jr., and John Chalmers DaCosta. Each made unique and lasting contributions in surgery. Additionally, they enhanced the reputation of Jefferson both locally and world wide. The following information highlights the career of Dr. Gibbon with recollections of him by two of his residents.

Life and Career of Dr. Gibbon

John H. Gibbon, Jr. (Fig. 1), a fifth generation physician, was born on September 29, 1903, in Philadelphia. His father, a graduate in the Class of 1891, was Professor of Surgery at Jefferson from 1907 until 1931. The younger Gibbon attended Penn Charter School and graduated from Princeton University (1923). After graduation from Jefferson (1927), he completed his internship at the Pennsylvania Hospital (1929) and accepted a research fellowship in surgery at the Harvard Medical School (1930/31). There he conceived the idea of developing an extracorporeal apparatus for temporarily supporting the function of the heart and lungs while taking care of a patient dying of pulmonary embolism.

In 1931/32 he served a Fellowship in Medicine at the School of Medicine of the University of Pennsylvania, but then returned to Harvard, again as a Research Fellow, for 1933/34. Dr. Gibbon then started a surgical practice in Philadelphia but became so intrigued by the possibilities of a heart-lung machine that he devoted full time to this project as a Harrison Fellow of Surgical Research at the University of Pennsylvania from 1936 until World War II intervened. He entered the service in January, 1942 (Fig. 2), and was sent to New Caledonia in the China-Burma-India theater of operations.

After Army service until 1945 and a one-month stay at the University of Pennsylvania, Dr. Gibbon resumed his investigations at Jefferson in 1946 as Professor of Surgery and Director of Surgical Research. Supported by the International Business Machines Corporation and the National Heart Institute, his invention was proven practical after many successful trials on cats and dogs. It was ready for human surgery in 1953.

In terms of the heart-lung machine being Dr. Gibbon’s “baby”, the idea was conceived at Harvard, the embryo developed at the University of Pennsylvania, and the fetus matured and was delivered at Jefferson.

On May 6, 1953, Dr. Gibbon successfully repaired an interatrial septal defect in the heart of an 18-year-old girl from Wilkes-Barre, Pennsylvania.
She had been connected to the pump oxygenator for 45 minutes, and for 26 minutes of that period all respiratory and circulatory functions were maintained extracorporeally. For the first time, a patient's heart and lung functions had been maintained entirely by a machine. This brilliant achievement initiated the era of open heart surgery for repair of congenital and acquired heart defects as well as the transplants of today (Fig. 4).

Dr. Gibbon was active in matters relating to health, training, teaching, research, professional organizations, and community affairs. He served on the American Board of Surgery of which he became Vice-Chairman, as Chairman of the Conference Committee on Graduate Training in Surgery, on the Surgery Study Section of the U.S. Public Health Service, the National Board of Medical Examiners, the Sub-Committee on the Cardiovascular System of the National Research Council, the Advisory Committee on Research on the Therapy of Cancer of the American Cancer Society and the Board of Health of Philadelphia.

He was Vice-President and President of the Philadelphia Academy of Surgery and of the College of Physicians of Philadelphia. He was President of the Laennec Society of Philadelphia and the Pennsylvania Association of Thoracic Surgery, Treasurer and President of the Society for Vascular Surgery, Vice-President and President both of the American Association for Thoracic Surgery, and the American Surgical Association and also Recorder of the latter. He was a long-time Governor of the American College of Surgeons and served on several of its important committees. Membership was awarded him in the American Academy of Arts and Sciences, in the National Academy of Sciences, and honorary fellowship in the Society of Thoracic Surgeons of Great Britain and Ireland and in the Royal College of Surgeons of England.

Although best known for his heart-lung machine, Dr. Gibbon made other research and clinical contributions. He was a distinguished editor of Annals of Surgery, author of Surgery of the Chest, and chapters in many books. He received honorary degrees from Buffalo, Dickinson, Duke, Jefferson, Pennsylvania, and Princeton. Other
awards of distinction were the John Scott (Board of Directors of City Trusts of Philadelphia), Charles Mickle (Toronto), Shaffrey Medal (St. Joseph’s), Matas Award in Vascular Surgery (Fig. 5), Distinguished Service Medal (Pennsylvania Medical Society), Research Achievement Award (American Heart Association), Roswell Park Medal, Albert Lasker Award in Medical Science, Dixon Prize in Medicine (Pittsburgh), Strittmatter Award of the Philadelphia County Medical Society, and the Philadelphia Award. His portrait was presented to Jefferson Medical College by the Class of 1963 and his name was inscribed on Jefferson’s Winged Ox Column of the 50 most notable physicians in medical history. Last but not least, the Medical College students continued the tradition of the Gross Surgical Society, followed by the Keen Surgical Society, and then as Gibbon Surgical Society (Fig. 6).

Dr. Gibbon retired to his farm in Media, Pennsylvania, in 1967 at the age of 64 (Fig. 7). On February 5, 1973, he died while playing tennis (Fig. 8), just prior to the planned celebration of the 20th anniversary of his first successful open heart operation, and just short of age 70.

In 1985 a combined M.D./Ph.D. program was initiated at Jefferson under the aegis of the Medical College and College of Graduate Studies. It was named the Gibbon Scholar Program. It involved seven years of study divided between the two colleges, in which the first, fourth and fifth were spent in the College of Graduate Studies and the second, third, sixth and seventh in the Medical College. The attractiveness of this unique program was further enhanced by financial aid.

Given his vast investigative and clinical accomplishments, it was fitting that his Jefferson alma mater honored this scientific giant with an annual John H. Gibbon, Jr. Lectureship of which the first was in 1987.

Jefferson finally paid Dr. Gibbon a remaining highest honor in 1991. On January 9, in an impressive ceremony, it renamed its New Thomas Jefferson University Hospital the Gibbon Building (Fig. 9).

Fig. 4. Dr. Gibbon with his heart-lung machine.

Fig. 5. Dr. Gibbon with Dr. Rudolph Matas, a pioneer in surgery for aneurysms.

Fig. 6. Left to right: John H. Gibbon, Jr. (JMC, ’27), Dr. Gordon Thomas, Director of Grenfell Mission in Labrador, and John Y. Templeton, III (JMC, ’41), at meeting of Gibbon Surgical Society.
Fig. 7. Dr. Gibbon in retirement on his farm in Media, PA.

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Fig. 8. Dr. Gibbon playing tennis at his home in Media.

In honor of
John H. Gibbon, Jr., MD
Researcher, Teacher,
Surgeon and
Inventor of the
Heart Lung Machine
1990

Fig. 9. Plaque in Tenth Street entrance of 1978 Thomas Jefferson University Hospital, named in honor of Dr. Gibbon.
[Editorial note: This highly technical account documents what has proven to be the most significant of Jefferson’s contributions to cardiac surgery. It has brought lasting fame to this institution and untold benefit to mankind.]

The Surgical Research Laboratory was located in Room 831 of the College Building at 1025 Walnut Street. The primary direction of the laboratory was continued studies of extracorporeal circuits and their ultimate application in maintaining the cardiorespiratory functions of a patient during open cardiectomy for the repair of congenital defects.

As a result of Dr. Gibbon’s effort with Mr. Thomas Watson, Chairman of the Board of the International Business Machines Corporation, the first machine was constructed. Don Rex was the engineer at IBM involved in the construction of the modified Gibbon heart-lung device. The machine was a physical improvement of the original extracorporeal circuit described by Gibbon differing only in its external appearance and mechanical configuration. The collecting bowl at the bottom of the oxygenator cylinder was heavily gold plated, as a means of providing a metal interface which was presumably less reactive with the elements of the blood. The rotating cylinder oxygenator had been enlarged with the expectation of increasing the oxygenation capacity sufficiently to maintain total perfusion of small dogs.

As a result of animal experimentation with the new device it became clearly obvious that this extracorporeal circuit was unsuitable for maintaining the cardiorespiratory functions of a large dog. There were multiple deficiencies in the device. The oxygenating capacity of the cylinder, despite the fact that it presented a large surface area at the blood interface could not oxygenate blood at a flow rate of five liters per minute which would be necessary for human cardiac bypass. Hemolysis within the extracorporeal circuit was unduly high. The automatic arterial control was erratic in performance and could not be relied upon for precise control of the speed of the arterial pump. Unknown at that time was the fact that air embolization, as a result of open cardiectomy in the presence of septal defects either in the interatrial or ventricular septum during extracorporeal per-

Fig. 1. Sketch of the apparatus used in testing the oxygen uptake of blood filmed on two-inch strips of screens and other materials.
fusion, presented the hazard of air embolization to the systemic circulation, particularly to the heart and brain. In addition, the volume of cardiac venous blood returning from the coronary sinus, the anterior cardiac veins and the Thebesian system was of unexpected volume and presented a significant problem insofar as recovery during open cardiotomy and total perfusion was concerned. Also, unknown at that time was the fact that respiratory acidosis incident to the anesthesia during thoracotomy resulted in profound respiratory insufficiency and high mortality in experimental animals.

The method of exposing both surfaces of a vertical blood film to oxygen and the use of turbulence as the blood film descended, as originally described by Drinker and Richards, was now applied by Stokes and Flick. This resulted in significant improvement in oxygenation. Accordingly, the first experiments with an oxygenator embodying turbulence involved lining the cylinder with a stainless steel screen. At this point, the engineering staff of the International Business Machines Corporation, consisting of Mr. Malmrose, Senior Engineer, John Engstrom and Leo Farr became involved in the design of a new machine containing an oxygenator using turbulence. In addition, much consideration was to be given to the major problem of precise control of blood volume and the prevention of malfunction of the arterial pump.

In 1950, this author became Dr. Gibbon's research assistant and subsequently research associate until the end of 1954. There developed a close working relationship between the laboratory at Jefferson and the engineers at IBM, including frequent telephone conversations and visits to the laboratories at Jefferson and the International Business Machines Corporation. An experimental program was undertaken with the purpose of determining the most efficient turbulent surface and geometric design for the oxygenator. Accordingly, strips of varying types of stainless steel screen varying in gauge and configurations were studied for their oxygenation efficiency. In order to secure comparative data on the oxygenating capacity of
various turbulent surfaces, a simple apparatus consisting of a trough type weir (a slot through which blood passed in order to form a film of uniform thickness) with a sliding side for regulating the thickness of the blood film was made to accommodate a strip of either metal screen, smooth metal plate, or similar plastic surface, measuring 2.54 cm. in width and 30 cm. in length. The entire apparatus was then placed within a plastic cylinder and exposed to an atmosphere of oxygen at room temperature (Fig. 1). The test screen was filmed with desaturated beef blood and determinations of oxygen uptake after a single passage were made. The volume of the blood film, pH, oxygen and carbon dioxide content were made at varying rates of blood flow.

Beef blood previously obtained from the abattoir was first desaturated by exposing the blood film in the rotating smooth cylinder oxygenator to an atmosphere of carbon dioxide in order to lower the pH and desaturate the blood with oxygen. When the desired level of desaturation with oxygen was achieved, the carbon dioxide was displaced by exposure of the blood in the oxygenator to nitrogen with resulting elevation of the pH to a normal level.

Various turbulent surfaces were studied with this apparatus. Among the materials used were stainless steel screens of different wire sizes, meshes and configurations. Screens made of plastic materials and perforated smooth metal surfaces were found to be physically unsuitable. The screen selected was made of stainless steel wire of 0.029" in diameter with rectangular meshes horizontally arranged. The screen provided an ideal turbulent surface and provided the highest degree of saturation with oxygen with acceptable hold up of blood. Stainless steel screens made of larger wire sizes were found to produce marked increases in the volume of blood held on the screen and difficulties in maintaining the film. At this point, the first device constructed by IBM was used to evaluate various oxygenators and electronic controls. The first screen oxygenator based on the data obtained from the in vitro studies was constructed in the form of a vertical cylinder capped by a bullet shaped head of smooth stainless steel (Fig. 2). Blood was distributed on the bullet shaped top by a rotating jet and the film produced descended by gravity on both surfaces of the screen. This method
produced a film of unpredictable quality and thickness. It was found necessary to initially brush the screen with blood in order to establish a complete film. The film once established was maintained as long as blood continued to flow from the rotating jet at the top of the bullet shaped head. Once the flow of blood was interrupted, the film was then lost and could be reestablished only by brushing the screen surface again. Contamination of the blood was a serious concern in this instance. This particular oxygenator had been designed to increase the saturation of blood from 65 to 95% at a flow of 1000 ml. per minute and was found to fulfill the design specifications.

In order to carry the entire circulation of an average sized dog, it was necessary to provide an oxygenator capable of oxygenation from 65 to 95% at a flow rate of a minimum of 2,000 ml. per minute. A vertical screen oxygenator of this configuration and size would require a surface area of at least 8,000 square centimeters and would have been cumbersome and impractical to use.

The geometric form was then changed to a series of six flat screens suspended in parallel from a distributing chamber containing six weirs or slits and enclosed in a clear plastic case (Fig. 3). This design, so called “storage battery oxygenator”, was suggested by Mr. Alf Malmrose the engineer directing this phase of the project. Each screen measured 45 cm. in height and 30.5 cm. in width providing the required surface area to effect an increase in saturation with oxygen from 65 to 95% at a flow rate of 2,000 ml. per minute. Since the blood film was exposed to oxygen on both sides of each screen, the area exposed to oxygen was approximately 1.6 square meters. In order to maintain the film on the screen after initial filming and standby periods, it was necessary to provide a continuous flow of blood over the screen surfaces. Accordingly, a recirculating pump was introduced into the extracorporeal circuit for this purpose.

The screen assembly was suspended in a plastic case and was further stabilized by securing the bottom of each screen in a separate slot within a block of plastic positioned at the bottom of the screen. In addition to stabilization of the screens, the plastic member reduced the volume of blood held in the pool at the bottom of the case.

The distributing chamber at the top of the oxygenator was made of clear plastic which tapered to a tube at the apex providing a means of evacuating air which might have entered during filling or inadvertently as a result of an unrecognized leak on the negative pressure side of the venous or recirculating pumps. The floor of the distributing chamber consisted of a series of weirs or slits measuring 0.15 mm. in width and 16 mm. in depth. The volume of blood in the distributing chamber was held to a minimum in order to reduce the total holdup of blood within the circuit. Oxygen entered the case through a long vertical tube with perforations on one side and escaped through the open ends of three tubes that varied in length and positioned on the opposite side of the screens in order to provide uniform exposure of both surfaces of all screens.

Electrically heated nichrome wires were embedded within the oxygenator case in order to maintain the case temperature slightly above body temperature and so prevent condensation of aqueous vapor on the interior of the case. In addition, an electrode consisting of a small metal plate was sealed within the wall of the case at the position at which the blood level was to be maintained in the pool at the bottom of the oxygenator by the arterial pump.

In order to establish the film on the screens of the oxygenator, the entire case was flooded to the top with saline solution. With both the venous and recirculating pumps, blood was pumped into the weir chamber. The mixture of saline and blood was rapidly drained by means of a large drainage port at the bottom of the oxygenator case and as the mixture of blood and saline descended, the thick layer of blood at the very top of the saline wiped the screens on both surfaces and established a uniform film on all screens. The drainage valve was then closed when only a very small amount of blood remained in the pool at the bottom of the oxygenator case; the venous pump was stopped and the recirculating pump set at the predetermined speed. The modified circuit is shown in Fig. 4.

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Three pumps in the circuit were of the roller DeBakey type without internal valves. The portion of tubing which was in the pump was grasped by a flange and firmly held in position by semicircular metal bars. This prevented any tendency of the tubes to advance and become displaced during the pumping cycle. The tubes were made of pure gum rubber and were internally coated with silicone to provide a non-wetting blood interface for the purpose of decreasing hemolysis. A roller at each end of the rotating arm of the pump progressively compressed the rubber tubing thus propelling the blood forward. As one roller left the fixed portion of the flanged tubing, the roller at the other end of the revolving arm began to engage the tubing in order to prevent backflow. The sucking action of the pump was produced by the elastic recoil of the rubber tubing after the roller had passed over it. To minimize hemolysis, the rollers were adjusted so that they did not completely compress the rubber tubing as they passed forward.

In addition, each roller rotated in a counterclockwise direction. This eliminated grinding action between the two inner surfaces of the rubber tube which were brought in light contact by the compression of the roller, thus reducing hemolysis. In this modified machine the pumps were driven by direct current motors. Stainless steel connecting tubes used to join the plastic tubing of the circuit were ground to a knife edge in order to minimize turbulence and possible hemolysis.

The venous pump (D) withdrew blood from the...
venae cavae during both partial and total circulation. The burette provided a means of introducing additional blood to the circuit to correct small losses in blood volume during the period of total perfusion. When the flow rate through the venous pump exceeded the volume of blood supplied by the vena cava, collapse of the veins from which the blood was withdrawn resulted in immediate cessation of blood flow into the extracorporeal circuit unless the suction produced by the venous pump was quickly terminated. As the flow rate through the circuit was increased or the volume of blood in the circuit decreased, there was usually a preliminary fluttering or intermittent collapse of the vein from which the blood was being withdrawn before complete occlusion occurred. It was then necessary to diminish the rate of the venous pump or adding blood to the extracorporeal circuit depending upon which was needed. It was found advantageous to provide some warning when a critical flow rate through the venous pump was approached. A small segment of this walled rubber tubing sensitive to small changes in pressure was interposed in the venous line. Changes in diameter of this segment of tubing were detected by a sensor consisting of a spring loaded plunger placed in contact with the tubing wall. The position of the plunger was then monitored by a variable linear differential transformer. Change in the tube diameter resulting from intermittent collapse produced a warning audible signal and also a visible indication on a meter which alerted the perfusionist to either reduce the flow rate of the venous pump or provide additional blood to the circuit.

Pump (P), the recirculation pump, had a two-fold purpose. One function was to maintain a uniform and complete blood film over the screens after it had once been established. The second purpose was to prevent change and maintain the volume of blood in the oxygenator with varying flow rates through the extracorporeal circuit. This pump was set at a constant flow rate which was higher than that required for perfusion.

As the flow from the venous pump increased, there was a resulting decrease in the volume of blood drawn from the bottom of the oxygenator for recirculation. The resulting rise in blood level in the pool at the bottom of the case then automatically energized the arterial pump to return an equivalent volume of arterial blood to the subject being perfused by means of a cannula placed within the femoral artery. The pump could be manually controlled but during perfusion the speed of the pump was automatically controlled by the position of the blood volume in the bottom of the oxygenator case by a new electronic device.

It was critical that the blood volume in the bottom of the oxygenator be held constant in order to prevent changes in both the animal's circulating blood volume and the volume of blood within the circuit. It was also of great importance that the level of blood in the reservoir should never fall so low that oxygen would be pumped into the arterial line. In such a case, the resulting gas embolism was rapidly fatal.

The original photoelectric control circuit was completely unreliable and malfunctioned frequently. Accordingly, a newly devised electronic circuit continually measured the capacity between the blood level and the electrode which had been sealed within the wall of the oxygenator case. The blood level and the electrode functioned as part of a tuned capacitance across the inductance in a high frequency oscillator operating at 10.7 megacycles. The capacity was proportional to the rise or fall in blood level and resulted in a frequency shift of the oscillator. The signal produced was then used to control the current to the armature of the direct current motor of the arterial pump. With this control the pump could be driven to full speed by a change in blood level of 3/16ths of an inch. This amounted to a change in volume at the bottom of the oxygenator of approximately 50 ml. at a flow rate of 2,000 ml. per minute.

Before return to the subject being perfused, the arterialized blood was first passed through a Monel metal filter on the output side of the arterial pump. This filter was made of Monel metal with a wire size of 0.14 mm. diameter and mesh of .3mm. which was contained within a transparent plastic case with a side tube which provided a means of re-
Fig. 5. Second IBM machine used by Dr. Gibbon in the first open heart operation for the repair of an interatrial septal defect in 1953 (A, front view; B, top view).
moving any bubbles or fibrin which might inadvertently have been present. The filter functioned in reverse fashion with the blood filtering through the screen from the exterior surface.

Experiments with the modified apparatus containing the new battery type oxygenator, showed the new arterial control and flutter indicator were encouraging and a significant improvement over previous experiments. In a series of twenty-one such experiments the mortality rate at this point was approximately 60%. This was a significant improvement over the mortality rate of 80% which had been reported prior to 1950. The mortality rate was unduly high despite the apparently satisfactory condition of the animals during perfusion.

Gasometric studies of the subject’s arterial and venous blood during anesthesia with the laboratory respirator revealed marked hypoxia and acidosis. The concept of increasing gas exchange by further evacuating reserve gas from the lungs with the use of suction during expiration was conceived. A new respirator containing a timing circuit which alternately operated solenoid valves on both the inspiratory and expiratory sides of the device was constructed. Expiration was assisted by suction produced by a Venturi jet within the circuit. The rate of insufflation and the ratio of expiration to inspiration was controlled by an electronic multivibrator circuit. With the new device it was possible to supersaturate blood with oxygen utilizing room air for ventilation. Carbon dioxide could be removed from the circulating blood of the subject to the point where the animal would remain apneic for a number of minutes after anesthesia was terminated. This device was used in all subsequent experiments and hypoxia and acidosis were no longer perplexing problems. The principle of expiratory assistance was subsequently applied clinically by Dr. George Haupt in the design of a mechanical counterpart to the electronic respirator.

During this period, in the development of additional components to the circuit and design changes there were frequent consultations with the engineers from IBM, either by phone or by very frequent visits to the laboratory. The new electronic devices which had been designed and constructed

Fig. 6. Diagram of final extracorporeal blood circuit. (For description see text.)

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in the laboratory were first demonstrated in actual operation to the engineers. Further improvements in the circuits and mechanical configuration were made by the engineers at IBM. The final form of the devices was then sent to the laboratory for further evaluation in animal experiments (Fig. 5a and b).

Many prominent scientists from the United States and abroad were frequent visitors to the laboratory. To name some, Drs. Clarence Crafoord and Ake Senning from Sweden, Dr. Clarence Dennis from the University of Minnesota, Dr. Michael DeBakey from the University of Texas, Dr. Wilem Kolf of the Cleveland Clinic and many others. In addition, Dr. Nicholas Gimbel from the University of Pennsylvania and Dr. Hans Engell from Denmark spent prolonged periods in the laboratory either observing or participating in the daily experiments.

Significantly, one of the very strong features of the surgical residency at that time, was the opportunity afforded to the residents to rotate through the laboratory for a major part of their training. Among these were Dr. Anthony Dobell who subsequently became Chairman of Cardiovascular and Thoracic Surgery at McGill University in Montreal, Dr. Charles Fineberg, Dr. Hal Cohn, Dr. Victor Greco, Dr. Burgess Smith and a number of others.

This was indeed an outstanding experience for the residents in cardiac surgical technique and observing cardiovascular and respiratory physiology during total perfusion.

Pumps (C) and (D) withdrew venous blood from each vena cava (Fig. 6). Pump (F) was the recirculation pump that provided continuous flow in excess of the maximal expected flow rate over the screens and maintained the blood film in the oxygenator. Pump (K) returned oxygenated blood from the pool at the bottom of the oxygenator to the subject.

In the final design of the flutter controls, the sensor was changed to the variable capacitor which functioned extremely well in the arterial circuit and further simplified the mechanical design. Minute changes in the diameter of the tube, as a result of variations in pressure, produced the necessary control signal to effect reliable automatic control. At

the moment of occlusion of the vena cava as a result of excessive flow rate, the event was sensed by this device and the venous pump motors were instantaneously stopped by the application of direct current. The moment of intermittent pressure variation preceding complete occlusion of the vena cava was indicated by a loud audible signal and also visible fluctuation on a meter. In the previous device, all pumps were activated by direct current motors which characteristically produced low torque at low speed. To overcome this feature, the venous and recirculating pumps were now activated by alternating current motors operating at a fixed speed. Variation in pump speed was then produced by variable mechanical transmissions interposed between the pump head and the motor. The motor controlling the arterial pump was a direct current motor controlled by the variable capacitor circuit.

Four self-balancing recording potentiometers mounted on the front panel of the machine were used for both monitoring and control purposes. One recorder received the signals from three thermocouples indicating the blood temperature on the venous and arterial limbs of the machine and the subject's body temperature by means of a rectal thermocouple. In order to maintain a normal temperature, an electrically operated heater assembly was positioned at the input of the oxygenator. The mass of the heater assembly was insufficient and the high temperature gradient necessary for this purpose resulted in excessive hemolysis and its use therefore was discontinued.

Another recorder indicated the flow rate through the extracorporeal circuit. The transducer for this purpose was a square wave magnetic flowmeter placed within the arterial limb of the circuit. A third recorder continuously indicated the pH of the arterial blood by means of electrodes placed in the arterial limb for the purpose of maintaining a normal pH. During standby periods, the flow of oxygen across the screens resulted in alkalosis. At this point, a mixture of oxygen and 5% carbon dioxide was automatically substituted for the pure oxygen until the pH was lowered to a normal range. During perfusion alkalosis was not present and the
ventilating mixture containing carbon dioxide was automatically interrupted and pure oxygen was introduced into the oxygenator.

The fourth recorder indicated the saturation of arterialized blood with oxygen before returning to the subject. A cuvette placed within the arterial limb measured the light transmission at 620 and 540 Angstrom units. All data derived from the recorders was imprinted on a strip chart.

Pressure sensing devices were incorporated within the extracorporeal circuit. One sensor was positioned proximal to the weirs and sensed pressure within the recirculating circuit. A pressure in excess of 300 mm. Hg, resulting from clotting or the accumulation of fibrin at the weirs indicated complete malfunction of the oxygenator and automatically stopped all pumps. The blood film would drain from the screens into the collecting chamber at the bottom of the case and could be returned to the subject by manual control of the arterial pump. Further perfusion was not feasible at this point. An increase in pressure in the arterial line as a result of obstruction automatically stopped the venous and arterial pumps but recirculation continued within the oxygenator circuit so that the film was not lost. Perfusion could then be resumed after the problem was corrected.

The control valves for the ventilating oxygen or oxygen carbon dioxide mixture were located to the side of the machine. There was also a gas flowmeter and provisions for humidification of both gases prior to their entry into the oxygenator case. Viewed from the front, the six meters situated at the very top of the machine were either tachometers indicating the speed of the pumps or in the instance of the two venous pumps two were additional flutter indicators. The pilot lights located above the meters indicated whether or not the machine was operating in automatic or manual mode. The large metal knobs located at the side of the meters were used to control the speed of the A.C. motors by means of the mechanical transmissions. Small knobs located just beneath these were used to select the mode of operation, namely manual or automatic. The panels on the left side of the front of the machine containing a number of

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Fig. 7. The cardiac blood collecting apparatus.

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controls were part of the oximeter circuit. Additional controls placed beneath the oximeter were used to activate the recorders.

The entire machine was enclosed, although not sealed hermetically. The atmosphere within the machine was converted to pure nitrogen from a tank of compressed gas and maintained at a few centimeters positive pressure. At that time volatile gases were utilized in the operating room and since the arterial motor contained a comutator and brushes there was the possibility that an explosive gas mixture might enter the cabinet resulting in an explosion.

There was in addition, an emergency power source consisting of a bank of storage batteries providing 32 volts D.C. and a motor generator to provide 110 volts A.C. In the event of failure in the main electrical supply of the hospital, the electrical supply for the machine would then transfer automatically to the emergency power supply. Because of limited capacity in this emergency power supply, the recorders and automatic control circuits would then be inactivated because of the current requirement and the machine could then be operated manually.

A number of experiments were then undertaken with the new machine in which the cardiorespiratory functions of medium sized dogs were maintained for prolonged periods. The survival rate was 80% and the period for complete total perfusion was extended to 100 minutes with prolonged survival. It was then apparent that perfusion with a mechanical heart and lung device was completely feasible and its application in cardiotomy was seriously envisioned. A number of experiments were performed in which the atrium was widely opened during total bypass and the bloodless interior of the heart chamber exposed with prolonged survival.

The volume of venous blood returning by way of the coronary sinus and Thebesian system was surprisingly much greater than anticipated. This large volume of blood needed to be recovered and returned to the extracorporeal circuit in order to precisely maintain the patient’s blood volume and that of the machine. In addition, when the first interatrial septal defects were produced, the hazard of air embolization as a result of air being trapped beneath the mitral leaflets then forced into the aorta became apparent. During these experiments the heart continued to pulsate during cardiotomy. A number of animals were lost as a result of air embolization to the coronary arteries.

The problem was solved by the introduction of a vent into the left ventricle. Since the aortic pressure during perfusion is many times greater than the pressure within the vent tube, the blood and air present in the left ventricle would then be expelled through the vent tube rather than into the aorta during ventricular systole.7

During total bypass and prior to a right atriotomy in the presence of either an interatrial or interventricular septal defect, a small tygon tube was introduced into the left ventricle through a stab wound in a relatively avascular area at the apex. The tube was then connected to a specially designed chamber capable of dispersing any air bubbles that might be present. In addition, sufficient negative pressure was maintained within this

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chamber to aspirate blood from the open cardiac chambers. The negative pressure was limited to 30 mm Hg. to prevent extraction of gas and the formation of foam.

Blood from both sources then accumulated in a pool at the very bottom, the position of which was sensed by the variable capacitor circuit previously described. A separate pump then reintroduced this blood to the extracorporeal circuit (Fig. 7). Using this particular device there was no blood loss from the left ventricle and the blood loss from the open cardiac chamber was minimal, thus accurately maintaining the respective blood volumes. Air embolization was consistently avoided in a large number of animals in which atrial septal defects were experimentally produced during cardiac bypass and subsequently repaired with a patch graft of pericardium.

Interatrial septal defects were then produced under direct vision and measured an average of 2 cm. in size. These were repaired by pericardial grafts. In some situations the pericardial flap was placed within the atrium through a stab wound at the base of the auricular appendage in order to maintain a pedicle and ensure some degree of viability. In all instances in which these animals were subsequently examined after surviving sufficiently long to ensure healing, all grafts were noted to have healed completely to the rim of the defects. In addition, those in which the pedicle had been maintained exhibited marked fibrosis in the pedicle. As a result of this the procedure utilizing the pedicle graft was subsequently abandoned. This represents the first attempt at producing interatrial septal defects during cardiopulmonary bypass and repairing them with pericardium (Fig. 8). A similar series of experiments involved the production and repair of interventricular defects during bypass with repair by direct suture closure or graft (Fig. 9a and b). Because venous pumps were at heart level a moderate degree of suction was needed to ensure maximum flow rate of caval blood. To further minimize the problem of fluttering, additional modification was made using mild negative pressure. Caval blood was directed into a separate collecting chamber such as the collect-

Fig. 9a. Experimentally produced interatrial septal defect repaired with pedicled pericardial patch in a dog heart.

Fig. 9b. Experimentally produced interventricular septal defect in a dog's heart with partial correction.
ing chamber for cardiac venous blood. The level of blood in the pool at the bottom of the chamber was again sensed by the variable capacitor circuit and from there on the circuit was as before (Fig. 10). Under normal conditions all that was needed to initiate bypass and perfusion was the removal of hemostats from the venous and arterial line and securing the ligatures about the vena cava, thus directing all venous blood into the cannulae within them. As blood from the subject entered the extracorporeal circuit, the heart-lung machine would then function automatically requiring only occasional adjustment to the negative pressure in the collecting chambers and the addition of small amounts of blood as needed.

As a result of a large and successful experimental experience with the apparatus which functioned splendidly, Dr. Gibbon and this author, together with the laboratory group had every confidence that the next phase, namely the use of the apparatus in operations upon humans would also be successful. Accordingly, Dr. Gibbon initiated the use of the device in human applications.

In preparation for this phase it was necessary to increase the capacity of the oxygenator which had been designed to oxygenate blood at a flow rate of 2000 ml per minute. The oxygenator fulfilled the original engineering specifications. In order to provide a flow rate of 5,000 ml. per minute which was necessary for human application, the oxygenator was enlarged to a series of six flat screens 30.5 cm in width and the length was increased to 60 cm. This oxygenator was capable of oxygenating blood from 65% to 95% saturation with oxygen at a flow rate of 5000 ml. per minute.

Two children failed to survive for reasons other than failure of perfusion. Finally in May of 1953, the first open cardiotomy for the repair of an interatrial septal defect in an 18-year old female patient was performed by Dr. Gibbon. The same heart-lung machine was moved to the hospital operating room along with the laboratory device used to aspirate the left ventricle and also remove the blood from the open right atrium.

The ultimate safe outcome of this performance can be attributed to the complex controls which had been incorporated into the device. During the
end phases of the repair of the interatrial septal defect, the weirs in the oxygenator suddenly occluded. As a result of the increase in pressure in the recirculating circuit, the sensor proximal to the oxygenator activated and all pumps were stopped and perfusion ceased. Fortunately the problem was immediately recognized. The arterial pump was placed on manual operation. The oxygenated blood which had drained from the screens on the bottom of the pool was slowly returned to the subject by means of manual control of the arterial pump. Some additional blood was required and a bypass was quickly established between the burette and the input to the arterial pump allowing sufficient time for the atriotomy wound to be secured with a clamp. At this point the remainder of the operation was terminated without incident.

This first human performance established without doubt the feasibility of cardiotomy in a bloodless field while the cardiopulmonary functions were maintained by a heart-lung apparatus. This opened the vista to open heart surgery as we know it today.

References


John H. Gibbon, Jr., (JMC, '27):
A Resident’s Reflections
by Robert K. Finley, Jr. (JMC, '48)

To imprint is to establish a response in behavior. An example in animal husbandry is Mary’s lamb, who followed her wherever she would go. Teachers imprint students with an indelible distinguishing influence.

Dr. Gibbon imprinted a generation of surgical residents who served at Jefferson during the 1950s (Fig. 1).

To explain this, I need to sketch out the man who had such an influence on our lives and on the course of surgery.

He was a member of 33 societies and President of six, including the American Association of Thoracic Surgery, the American Surgical Association, the College of Physicians of Philadelphia, the Heart Association of Southern Pennsylvania, the Society for Clinical Surgery, and the Society for Vascular Surgery.
He published 125 articles in scientific journals, authored one book, and was editor of the *Annals of Surgery* for 10 years.

He received 11 awards, including the Albert Lasker Award for Clinical Research and the Distinguished Service Award of the International Society of Surgery.

He served as a visiting professor at the medical schools of Baylor, Harvard, Indiana and Vanderbilt Universities, and presented a number of distinguished lectures, including the Harvey Lecture of the New York Academy of Medicine, the Conner Memorial Lecture of the American Heart Association, and the Arthur Dean Bevan Lecture of the Chicago Surgical Society.

Dr. Gibbon served in the Army in the war years (Fig. 3); then returned to Jefferson in 1946 as Director of Surgical Research and Head of a Division of Surgery. He continued work on the heart-lung machine at Jefferson. On May 6, 1953, it was used successfully on a human to close an interatrial septal defect (Fig. 4). I was fortunate to be a surgical resident with him during that time.

He felt strongly that research should be combined with clinical surgery. The two disciplines should be practiced together. The first year of the surgical residency was spent in research in the laboratory.

In 1950, work on the heart-lung apparatus was Dr. Gibbon's most consuming interest, but he had
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other interests as well. Fred Coller, M.D., of the University of Michigan had described water intoxication in surgical patients. This condition arose from the use of glucose in water given post-operatively to surgical patients for a long period of time, producing an electrolyte depletion and water intoxication. Dr. John Templeton, '41, and I worked on this subject by noting changes in electrolytes in serum and urine of surgical patients who had esophageal resections. Dr. Gibbon obtained for us one of the first flame photometers in Philadelphia to study sodium, potassium and chloride. My introduction to research and its application to clinical medicine came as a result of my surgery residency with Dr. Gibbon.

The laboratory was part of the suite that contained the whole so-called "B" surgical department, or Dr. Gibbon's part of the clinical surgery. The other part of the surgical department was headed by Dr. Thomas Shallow. Dr. Gibbon was also in charge of surgical research. He had as associates Drs. Frank Albritten and John Templeton, and Dr. Bernard Miller as research director. All had offices in the suite along with the laboratories. The heart and lung apparatus under development was housed in the larger part of the laboratory. John Templeton and I shared an office and a smaller lab further down the hall. Frank Albritten's office was across from the larger laboratory containing the heart-lung machine. At that time much of the thrust was to prove that the heart-lung machine could sustain an animal for a reasonable length of time, allowing the surgery to be performed on the heart in a dry field.

Survival after such an intracardiac procedure was important and the recovering animals had to be nursed during the evening hours. Often they would wander through the suite during the evening and occasionally use whatever facilities were open to relieve themselves. Frank Albritten's office was a convenient spot and he was sometimes greeted in the morning by such a deposit. Dr. Gibbon was always able to smooth things over with grace. He assured all concerned that it would not happen again, the animals would be suitably confined, and so forth.
During that time, there was intense interest in the progress of the heart-lung machine. Many visitors came to the laboratory to see Dr. Gibbon and the work in progress. Dr. Gibbon always discussed and disclosed openly all of his work with the visitors who included Drs. DeBakey, Crafoord, Shumacker, Blalock, Bahnson, Gerbode and many others. Much of the engineering for the machine was done by International Business Machines Co. through the courtesy of Mr. Tom Watson, who came at least on one occasion to visit that I recall.

Dr. Gibbon was careful to give credit to those who helped. He often referred to Mr. Tom Watson’s support as well as to the roller pump described first by Dr. Michael DeBakey. Drs. Lane Stokes and John Flick had modified the oxygenator to make it much more efficient and he always referred to that. Dr. Bernard Miller did a great deal of work on the circuitry of the machine, which Dr. Gibbon acknowledged.

The clinical part of the residency was interesting. Dr. Gibbon had recruited a loyal group to operate the service consisting of Drs. George Willauer, John DeTuerk, Frank Albritten, John Templeton and Adolph Walkling. Others made important contributions but that group seemed to shoulder much of the work.

Dr. Gibbon operated in a spirited fashion and felt that the whole operation should move briskly. He operated in tennis shoes, which were appropriate. I recall an instance when one of the residents caught Dr. Gibbon’s hand in the rib spreader as he was removing it. That produced even more action. Our operating rooms were not equipped with air-conditioning then, so there was considerable mopping of brows during a procedure.

Closing of the interatrial septal defect was scheduled for May 6, 1953. We practiced the procedure in the laboratory before that day. As I recall, it was unreasonably warm, so the windows had to be open for air. The hospital was under construction then and pile drivers were used to drive steel supports into the earth just outside the lab. The heat and noise were intense.

Frank Albritten had a new camera which he wanted to use. It had flashbulbs which produced a bit of heat. We had just opened the atrium so Frank wanted a picture of it but got a little close to the back of Dr. Gibbon’s neck, flashed it, and Dr. Gibbon jumped in response. We were all quite intent on the subject at hand, but Dr. Gibbon had time for an expletive, at least. The case went on satisfactorily. We felt ready for the first human case.

May 6th, 1953, started early for Dr. Bernard Miller who got the machine up well before dawn. There was a great crowd of people in the operating room so Dr. Gibbon eliminated a number of them. Tom Nealon, S’44, the senior resident, exercised his status and replaced me as the assistant to Dr. Gibbon, while Frank Albritten acted as his first assistant. My role was to monitor the blood pressure through an arterial line in the radial artery. I recorded a brief operative note at the close of the operation. The case went well, the patient was cured, and the news of the procedure spread rapidly. We were all elated at the tangible success we saw.

Dr. Gibbon conducted teaching rounds on the ward each week when he was on. He would also come in to help a resident with a difficult case at night. I remember a particularly sick patient Dr. Charles Fineberg had, with a bleeding ulcer. Dr. Gibbon helped him in surgery during the night by pumping blood and starting IV’s.

He conducted student clinics in the amphitheater. It always amazed me that he would approach a case cold and give a very learned discussion of it. He would come down to the “pit” just before the clinic, ask a few questions about the cases, and start with the clinic. He had a tremendous grasp of the field of surgery.

Dr. Gibbon and his wife, Maley, usually had a Christmas party at their home on Pine Street for the people in the lab and the residents. There were few residents at that time so the group was not too large. He loved to make “fishhouse punch” in the bathtub. It was a beverage to induce conviviality in short order. I recall some very memorable conversations at those parties.

Remembering Doctor Gibbon’s energy, enthusiasm, optimism and naivete seems to have impressed me most. He usually bounded the stairs,
which may have kept him in shape for his tennis. He did smoke and never apologized for it. At the
time smoking was still common, although most of
the residents did not smoke after caring for patients
with carcinoma of the lung. He seemed eternally
optimistic. I can remember a patient who devel-
oped a leak from the duodenal stump after total
gastrectomy. She was very ill, but he was ever
optimistic about her and helped me as a resident
caring for her. He was extremely helpful to the
family and that impressed me. He seemed very
intelligent, yet naive in a refreshing way. He would
always accept whatever was told to him as fact. It
was a characteristic which allowed him to deal with
people very efficiently. They were all a little more
careful about what they said to him, knowing that
it was accepted as truth. He seemed to always say
yes and never refused a request, that I witnessed.
Many times the responsibility for carrying out
much of the task fell to other members of the staff,
but he could get anyone to do just about anything.

Dr. Gibbon was good to talk with. A resident
needs such a person. He was available to most
of us and never belittled anything we said or did.
He had approvals and disapprovals, but would
listen attentively while the position was explain-
ed. He encouraged us to think and to speak of
what we thought.

He encouraged our research efforts by review-
ing projects with us, and helped in the prepara-
tion of papers. Writing a paper with him was a
lesson in English as well as science. He felt strongly
that all of the data should be presented, while I
like averages, means, and so forth. The favorite
time for paper writing was Sunday afternoon at
his home. Some of those sessions could best be
described as a learning experience.

I was introduced to morbidity and mortality
rounds at Jefferson with Dr. Gibbon. I was
impressed that we discussed every death and every
complication on the surgical service. I believe he
got the idea from his time in Boston, and I have
carried it to my community. It is one of the more
valuable teaching mechanisms. Dr. Gibbon was
always careful to present his own complications
and be very frank about them. He always led the
discussion away from any personal confronta-
tions. Those guidelines have helped us all in in-
stalling such sessions.

There are a few people who influence us during
our life. I think most of us have someone in medi-
cine whom we admire and from whom we can
learn. At Jefferson, in the 1950s, there were many
people who were influential in shaping my career
in surgery, but Dr. Gibbon was probably the great-
est example. He created an atmosphere for young
people to grow and to learn, an environment that
allowed one to make mistakes and learn by them.
He was always supportive and stimulating to all
of us. At a time of imprinting, he was there to set
an example for us.

From the Era of Physiology to the Era of Technology:
Recollections of a Gibbon Resident
by Anthony R.C. Dobell, M.D.

I would like to recall Dr. Gibbon as I knew him
in the early 1950s, when I was a resident at Jeff-
erson Medical College. Serendipity had led me to him
as a student from another medical school, and my
first recollection is of a brief interview I had with
him at that time. I remember how energetic he
was and how he asked my opinion of the things
we talked about. He exuded a vitality that stimu-
lated the people around him. And from this inter-
view, I began to learn one important lesson: what-
ever subject we were going to discuss, I had better
have an opinion ready because he was going to
ask for it. Later on, I realized that Dr. Gibbon
treated all opinions with great respect, sometimes
greater than they deserved, and that it was therefore important to present well-considered judgments and information.

But let us set the scene. In the early 1950s, the Korean War was still in progress, commercial flights were propeller-driven, the few television sets were black and white, the West had all the atomic bombs, and mathematical calculations were done with slide rules.

During this period, Dr. Gibbon was at the peak of his career. He was a Professor of Surgery at Jefferson, where his father (Fig. 1) had also been a Professor of Surgery.

Born three years after the turn of the century, Dr. Gibbon was in his early fifties when I was a resident. His surgical preparation had begun with a research fellowship under Edward D. Churchill, M.D. at Harvard Medical School, and had continued in surgery and research at the University of Pennsylvania School of Medicine. Dr. Churchill, held in great respect by many later leaders of American surgery whom he trained, is regarded as Dr. Gibbon’s mentor. Certainly, Dr. Gibbon always spoke of Dr. Churchill with affection and a certain reverence, and echoed Dr. Churchill’s conviction that surgery was a single broad discipline, a conviction shared by many leaders of that period who opposed the establishment of subspecialties. Dr. Churchill has been described as a great humanist, and if this term is taken to indicate a lover of people, then it certainly would apply to Dr. Gibbon also. Dr. Gibbon married Mary Hopkinson, Dr. Churchill’s chief technician, and the marriage was so close and so central to the lives of Dr. and Mrs. Gibbon that it is no wonder they always spoke of Dr. Churchill with affection.

At the University of Pennsylvania, Dr. Gibbon worked closely with Dr. Eugene Landis, who subsequently became professor of physiology at Harvard Medical School. Dr. Gibbon’s preparatory years seem to have been divided equally between physiology and surgery.

In recalling the early 1950s, I think that Dr. Gibbon’s major interest was the editorship of the Annals of Surgery, the prestigious journal of great tradition that had long served as the vehicle for major advances in American surgery. The editorship was a responsibility that particularly suited Dr. Gibbon because he had a facility for the English language, a love of words, and a passion for learning of any advance in surgical knowledge. He told me once that he read and dictated an opinion on every paper submitted to the Annals while he was editor, and that sometimes he would override the opinion of those formally assigned to review a paper. I remember waiting in his office while he dictated some of these evaluations onto a floppy belt. He would turn on the machine and dictate straight through with no hesitation, no loss of his train of thought, no corrections. And his comments would include recommendation for changes in this table or that figure and always an analysis of whether the conclusions were justified by the data presented.

In those days, professors still taught entire medical school classes. One of the weekly features was Dr. Gibbon’s “Pit,” so called because the floor of
the auditorium was depressed and you reached it
via a subterranean passageway, as in a Roman
amphitheater (Fig. 2). Residents and interns sat in
the front row and behind them ranged the entire
senior class. The format was consistent: patients
were presented by clinical clerks, and Dr. Gibbon
would interrogate as he sought to bring out
important diagnostic or therapeutic points. He
was not informed in advance which patients
had been chosen by the residents, and sometimes
they would conspire to lead him astray with an
atypical presentation.

On the other hand, the residents were always
slightly nervous, lest some diagnostic study had
been omitted or a result forgotten. The sessions
were good teaching and good entertainment. In
addition to specific surgical instruction, Dr. Gibbon
taught the students to treat patients with
dignity and human interest, and medical and surgical
colleagues with respect and consideration.

Dr. Gibbon had a sizable practice, though lim-
ited by his many other interests, and it consisted
primarily of patients referred for lung, or, less of-
ten, esophageal cancer. The bronchoscopies or
esophagoscopies were done by Louis H. Clerf,
M.D. (Jefferson ’12) and his associates, who then
directed the bronchoesophagology clinic set up by
Chevalier Jackson, M.D. (Jefferson 1886). A conse-
quence was that the thoracic residents were ex-
cluded from this activity. At any rate, the result
was a steady flow of patients with lung and esoph-
ageal cancer. Dr. Gibbon’s tour de force was the
radical pneumonectomy.

I can recall his tall, energetic figure as he
scrubbed for such an operation. Clad in the white
scrub suit of the time, wearing old sneakers and
likely a white sweatband, he might talk of what a
splendid fellow the patient was and of how we
must get the cancer out and save his life.

The operation tended to be slightly hyperactive.
All vessels were clamped and tied with cotton
thread, and the electrocautery was never used.
Often, ties were passed on instruments that multi-
plied the movements in the operative field. The
pulmonary artery and veins were secured with
transfixion sutures, and the divided bronchus was
closed with interrupted sutures - of silk, as I re-
member. The paratracheal and subcarinal nodes
were removed with the specimen and the opera-
tion was aggressively done, yet in relative safety.

The patient would be returned to his or her room
wherever it might be located in the hospital, and
the residents would make rounds every few hours,
day and night, often performing nasotracheal
aspiration to remove accumulating secretions
from the remaining bronchus. The results were
outstanding, and Dr. Gibbon took great pride
in the postresection survival achieved by his
associates and himself.

Dr. Gibbon’s laboratory was located in the suite
containing the surgical offices. I was the resident
assigned to the extracorporeal circuit in 1953/54,
together with Dr. Hans Engell, a research fellow
from Copenhagen, who subsequently had a dis-
tinguished and productive career in his native

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Denmark. The daily activities of the laboratory were overseen by Bernard J. Miller, M.D. (Jefferson '43), a brilliant individual with broad surgical knowledge and interests. Dr. Gibbon rarely came to the laboratory at that time. He came when there were visitors like Crafoord or Senning or Bjork or Henry Bahnson, all of whom were determined to expand surgery to include intracardiac operations. But, in truth, there was little such drive at Jefferson in that year despite the successful closure of an atrial septal defect in May 1953, and possession of the only proven heart-lung machine in the world. The superb apparatus was primarily a laboratory tool, and a series of experiments were conducted throughout that year, first on closing ventricular septal defects and later on cardiopulmonary bypasses of two hours' duration.

It is hard to explain why successes were not forthcoming after the successful open-heart operation of May 6, 1953 (Fig. 3), which was only reported a year later in a regional surgical journal. Certainly, Dr. Gibbon knew the significance of his accomplishment and telephoned his friend Dr. Clarence Crafoord in Stockholm the evening of the procedure.

Why was the advantage not exploited? I think that with the successful procedure, Dr. Gibbon had achieved his goal, which was to take over the function of the heart and lungs of a human for a significant period of time. Initially, back in the 1930s, he had thought the indication might be for pulmonary embolectomy. After the war, Dr. Gibbon had thought the initial use might be in patients with intractable heart failure - that is, as a circuit to reverse secondary organ deterioration. The point is that Dr. Gibbon's focus was not the repair of congenital cardiac lesions, but rather the establishment of the heart-lung machine.

Fortunately, in the late 1940s Dr. and Mrs. Gibbon (they had worked together) had been befriended by Thomas Watson, the patriarch of IBM Corporation (Fig. 4). He became interested in turning their accumulated knowledge into a single technologic unit, and he assigned some of his brightest young engineers to the project over a period of several years. Mr. Watson stipulated that IBM would build a prototype and that it would never engage in commercial development. In fact, IBM constructed a prototype, improved it with a second design, and improved that with the final model.

The goal was to reproduce normal physiology - normal flow, normal pressures, normal acid-base balance, normal temperature, and so forth. Venous drainage, for example, was by gentle suction rather than siphon drainage, so that normal venous pressure would prevail in the venae cavae. No azygos flow here! No physiologic liberties were to be taken. Large paper recorders were to chart physiologic parameters during cardiopulmonary bypass. Unfortunately, most of the sensors were not up to this task and these records were not readily available, but the objectives of the apparatus were evident.

It is clear that Dr. Gibbon was a physiologic surgeon. His career spanned the era of physiologic surgery. Earlier, during the professional life of Dr. Gibbon's father (John H. Gibbon, M.D., Jefferson 1891) and before, the age of anatomic surgery was in evidence. Surgeons amputated, relieved obstructions, drained pus, and cut out tumors. Today we are in the age of technology, in medicine as in almost all things.
Fig. 4. Mr. Thomas Watson of IBM Corporation.