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Part II: Basic Sciences --- Chapter 4: Department of Biochemistry (pages 131-157)

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Previous histories of the Department of Biochemistry have been limited to a one-page summary by George R. Bancroft and a somewhat lengthier essay by Abraham Cantarow, both former Chairmen. Occasional mention of the affairs of the Department naturally occurred in the larger histories of the Medical College, such as those of Gayley, Gould, and Bauer.

Most subdivisions of this history correlated with the successive tenures of chairmen. There were two reasons for this: In the early history of Jefferson, there were “Chairs” rather than Departments, and practically no staff other than the chairmen; and beginning in the 1940s the Department developed into its present form, with staff members numerous enough to render impractical any fair description of their individual contributions to the teaching and research programs. In any case, each Chairman left a sufficiently personal imprint upon the character of this Department to justify dividing the history into periods of tenure of Chairmen.

Era of Medical Chemistry (1780–1840)

Although chemistry, in its various guises, made certain contributions to medicine in ancient and medieval times, it is obvious that truly rational additions from this science to the body of medical knowledge had to await the systematization of concepts and the elimination of alchemical impediments, which occurred toward the end of the eighteenth century. By the turn of that
century, Lavoisier and colleagues had developed an essentially modern nomenclature for chemistry, had clarified the concept of an element, had arrived at an understanding of the true nature of combustion and of animal respiration, and Proust had discovered the Law of Definite Proportions.

The quarter-century before the establishment of Jefferson Medical College saw the development of the atomic theory of Dalton, Avogadro's Law, and determination of the “combining weights” of many elements by Berzelius. In a more biological vein, one may list the discovery that urinary urea is the chief pathway of elimination of waste nitrogen (Fourcroy and Vauquelin, 1810), that nitrogen from the diet is needed for the support of the body (Magenie, 1816), the elucidation of the composition of natural fats (Chevreul, 1823), the finding of free hydrochloric acid in gastric juice (W. Prout, 1823), and the isolation of the amino acids cystine (Wollaston, 1810), leucine (J.L. Proust 1819, and Braconnot, 1820), and glycine (Braconnot, 1820).

The quarter-century coinciding with the tenure of the first Chair of Chemistry at Jefferson was a period of great activity, not only in pure chemistry, but also in its biological and medical applications. Berzelius determined accurate atomic weights for the known 50 elements (1826), Wöhler synthesized an “organic” substance, urea, from inorganic ammonium cyanate (1828), and, although little stressed in historical texts, organic analytical chemistry (begun by Lavoisier in the 1700S, carried forward by Gay-Lussac and Thenard, Berzelius, and Liebig) reached an important peak with the development of the Dumas method for nitrogen in 1833.

In the applied area, progress was made in understanding the process of digestion with the discovery of the digestive enzyme, pepsin (Schwann, 1835). The cell theory was promulgated by Schwann (1839), and fermentation was shown to be due to the action of living yeast cells (Schwann, 1837, Kützing, 1837, and Cagniard-Latour, 1838). During most of this period Justus Liebig contributed greatly to the understanding of “animal chemistry” through his papers and books, and clarified the nutritional relation of plants and animals on a global scale.

Jacob Green, M.D. Professor of Chemistry, Mineralogy, and Pharmacy (1824–1841)

Biographical information on Jacob Green ranges from the impersonal notices in the biographical dictionaries through the less systematic but warmer entries in the histories of the medical college to the very personal and poignant obituary by his father (in Gayley) and the scientifically detailed biography by the noted Philadelphia historian of chemistry, Edgar Fahs Smith.

Jacob Green (Figure 4-1) was born in Philadelphia on July 26, 1790, the son of Elizabeth Stockton Green and the Reverend Ashbel Green, pastor of the Second Presbyterian Church.

In terms of education and academic honors, Green, at the age of seventeen, graduated second in his class at the University of Pennsylvania and was valedictorian. Rutgers conferred another A.B. degree (honorary) upon him in 1812 and converted
it to an A.M. (hon.) in 1815, in which year Green also received an A.M. (hon.) from Princeton. Finally, Yale conferred an honorary M.D. upon him in 1827.

Green had a love for all of the natural sciences. His first subject of interest was botany, but soon also encompassed electricity (in which field he and a young friend published a book, at which time Green was only 19). While preparing that book for publication, Green apprenticed himself to a local physician in order to study medicine. Exposure to a particularly gruesome surgical procedure persuaded him that medicine was not to be his life's work.

In 1809 Green left Philadelphia for Albany where he engaged in the bookselling business for seven years. The venture was not a financial success, although he made use of the time also to study law and be admitted to the New York bar. In 1816 he returned to his parents' home in Princeton, the elder Green in the meantime having been appointed President of the College of New Jersey (later Princeton University). At this time Jacob Green's interest in religion intensified, and he began a study of theology with the intention of entering the ministry. This aim, however, was subverted. While assisting the Professor of Natural Philosophy at Princeton in scientific demonstrations for classes, Green's strong inclination toward science apparently was reawakened. A reorganization of the curriculum at the College created a Professorship of Chemistry, to which Chair Jacob Green was appointed at the age of 28. The appointment proved to be temporary; another reorganization of the curriculum in 1822 resulted in the elimination of the Professorship of Chemistry. Green and his father, who had in the meantime decided to retire from the Presidency of the College, returned to live in Philadelphia.

Green joined the small group with George McClellan who founded Jefferson Medical College and accepted appointment, in 1824 at the age of 34, to the Chair of Chemistry, Mineralogy, and Pharmacy in the first faculty. His father, the Rev. Dr. Green, became President of the Board of Trustees.

In 1828 Jacob Green made a seven-month pilgrimage to the scientific centers of England, France, Switzerland, and Germany, in the course of which he met many of the leading scientists of the day, including Dalton and Faraday. He returned with chemical and physical apparatus, books, and doubtless many ideas that he was to incorporate in subsequent books and papers.

Green was well liked by his colleagues on the faculty because he remained aloof from the internal bickering that characterized the early years of the new institution. He was popular also with the students, who referred to him (as reported by Samuel D. Gross) as “Old Jacky Green.” (The nickname appeared also in alternative spellings: Jakyl26, and Jaky24).

An accurate picture of what was meant by the “Medical Chemistry” of the day can be obtained from the content of Green's course. As stated in the Annual Announcement of 1832, it covered physics, inorganic chemistry, and the chemistry of “organic substances” of animal and vegetable origin. Examination of his textbook, which was based on Turner's Elements of Chemistry, revealed the following distribution of topics, expressed in terms of numbers of pages used as a percentage of the whole: Physics—15 percent, Inorganic Chemistry—58 percent, Animal and Vegetable Chemistry—23 percent, along with a small section on analytical chemistry and several useful tables of quantitative data. The distribution of topics in the textbook was exemplified by a set of lecture notes taken by Nathan L. Hatfield, a member of the first graduating Class of 1826. Examination questions from the course were recorded by a student in 1832 and a sample set published in the Annual Announcement of 1836. In both instances, the emphasis was on inorganic chemistry and detection of poisons.

In general, Green’s course and textbook were up to date for their time. In fact, the 1829 text referred to Wöhler's synthesis of urea from ammonium cyanate, although this had occurred only one year before publication of the book. On the other hand, Green did not use the symbols for the elements and compounds suggested by Berzelius and did not mention the discovery by Magendie that nitrogenous foods were necessary for life.

In the preface of his textbook, Green acknowledged the assistance of his friend, Charles
Davis, M.D., who was also listed as Adjunct Professor of Chemistry in the Annual Announcements of 1832 and 1833. There was no other evidence for a chemistry “staff” at this stage in the history of the Chair.

In addition to his lectures at Jefferson, Green also presented a series in chemistry during certain summer sessions at Jefferson College, Canonsburg, and Lafayette College, Easton.

Green made no major research discoveries, although he published scientific papers in many branches of the physical and biological sciences. His primary role was that of a disseminator of the discoveries of others. In this aspect, his roster of published books was noteworthy: An Epitome of Electricity and Galvanism (1809), coauthored with his friend, Erskine Hazard; A Catalogue of the Plants Indigenous to the State of New York (1814); Astronomical Recreations (1824); Electromagnetism (1827); Text Book of Chemical Philosophy (1829); Notes of a Traveller, 3 vols. (1830); Consolations in Travel (1830), by Sir Humphry Davy, edited by Green; The Botany of the United States (1833); A Syllabus of a Course of Chemistry (1835); A Monograph on the Trilobites of North America (1832, suppl. 1833); and Chemical Diagrams (1837). (Two biographical sources list also Diseases of the Skin (1841), probably an erroneous attribution—at no point in Green’s career did he evidence any interest in such a topic, nor is any such book listed under his authorship in the usual bibliographic references, and furthermore, he had virtually no medical training; his M.D. from Yale was honorary. A Jonathan Green did publish a Practical Compendium of the Diseases of the Skin [London, 1835, 1837; Philadelphia, 1838, 1839] suggesting a possible confusion between the two “J. Greens.”)

Jacob Green died February 1, 1841, at the age of 51, leaving behind a wife and two daughters. An interesting glimpse into the sometimes precarious financial state of the young Medical College is afforded by the fact that after Green’s death his estate was reimbursed for the loans he had made.5

Era of Physiological Chemistry (1840–1880)

The tenures of the three occupants of the Chair of Chemistry following Jacob Green coincided with the period denoted “Physiological Chemistry” by historians of the subject. It was an era characterized by many advances, both conceptual and substantive.

The development of accurate methods of quantitative analysis during the preceding period had brought on a spate of feverish activity, not only in the determination of the composition of purified compounds, but also in such overly zealous endeavors as the analysis of the elemental composition of whole tissues. Such excesses provoked reactions from two directions. On the one hand, the vitalists objected to what they called “analism,” on the grounds that decimation and analysis of an organism would teach nothing about the essential nature of living beings. On the other hand, researchers with a largely physiological background maintained that investigators could indeed study the phenomena of life, provided that they worked with whole organisms or, at least, intact organs.

Concurrently, the field of organic chemistry began to unfold as an independent discipline as chemists realized that their science need not restrict itself to compounds of animal or vegetable origin. This change in attitude was abetted by the rise of chemical industry, with its many areas of application of organic chemistry unrelated to biology.

The result of these events was a general abandonment of the field of biological chemistry by the organic chemists, at least for a time, leaving it in the hands of “physiological chemists,” sometimes actually located within departments of physiology in the medical schools. In Germany, early in the nineteenth century, chemistry was a medical discipline, but between 1820 and 1850 “philosophical” faculties were formed in the universities, and chemistry was recognized as a “pure” science and transferred out of the medical and into the philosophical faculties.

Among the major advances in pure chemistry during this era were the discovery of the law of conservation of energy (Mayer, 1840, 1842), the mechanical equivalent of heat (Joule, 1843; Helmholtz, 1847), the periodic law (Lothar Meyer, 1868, 1870; Mendeleeev, 1869, 1871), stereochemistry
(van't Hoff, 1874), the law of mass action (Guldberg and Waage, 1867) and the structure of benzene (Kekulé, 1865).

Discoveries and advances in physiological chemistry included the digestive enzymes (Mialhe—salivary amylase, 1845; Bernard—pancreatic enzymes, 1846 et seq.; and Kühne—the same, 1876), liver glycogen as the source of blood sugar (Bernard, 1848); isolation of many amino acids; the respiratory quotient (R.Q.) (Regnault and Reiset, 1849); nitrogen equilibrium (Voit, 1860s–1870s); and the beginning of the famous controversy over the necessity, or lack thereof, for living yeast cells in order that fermentation might occur (1830s–1897).

Despite these impressive accomplishments, historians were of the opinion that “Physiological Chemistry” did not have sufficient basic chemical facts and techniques at hand to stand as an independent discipline.

Franklin Bache, M.D. Professor of Chemistry (1841–1864).

Franklin Bache (Figure 4-2), a great-grandson of Benjamin Franklin, was born in Philadelphia on October 25, 1792, the son of Benjamin Franklin Bache. He prepared for entrance to the University of Pennsylvania by study in the local academy of the Rev. S. B. Wylie, a well-known teacher of Latin and Greek. Bache graduated from the University with a Bachelor of Arts degree in 1810, at which time he was the class valedictorian. He then began the study of medicine as a private pupil of Dr. Benjamin Rush, after whose death he continued with Dr. James Rush, Benjamin’s son. Bache then matriculated at the University of Pennsylvania, where he received his M.D. degree in 1814.

Bache served in the army during the War of 1812, but eventually resigned to take up private medical practice in 1816. He appears, however, to have had an even stronger interest in chemistry, having written articles on the subject while still a medical student. In the 1820s he lectured on chemistry to the students who were studying medicine with Dr. T.T. Hewson. Bache taught in a more formal setting beginning in 1826 when he was appointed Professor in Chemistry in the Franklin Institute, a position which he retained until 1832. He served as physician of the Walnut Street Prison beginning in 1824 and of the Eastern Penitentiary beginning in 1829, but resigned both positions in 1836. In 1830 he taught in one of the two “associations” formed for the purpose of providing private medical instruction in the city of Philadelphia. The Philadelphia College of Pharmacy appointed Bache to the Chair of Chemistry in 1831, a position he held until 1841, when he accepted the Chair in Chemistry at Jefferson.

Among professional associations, Bache was a member of the Kappa Lambda Society, the College of Physicians of Philadelphia, the American Philosophical Society (which elected him President in 1853, the first President having been his great-grandfather, Benjamin Franklin), the Academy of Natural Sciences of Philadelphia, and the National Institute at Washington, and was elected as honorary member of the Imperial Academy of Naturalists at Moscow. Among
nonprofessional associations can be mentioned the Temperance Society.

The chemistry course taught by Bache at Jefferson, according to the College Announcement of 1850, included a description of “all of the important chemical preparations embraced in the United States and British Pharmacopoeias,” as well as the chemistry of animal and vegetable substances. In an introductory lecture to the course, Bache went into greater detail: the course, after the usual preliminary background in basic physics, was to cover the nonmetals, laws of chemical combination, metals, and “organic substances.” These last were subdivided into “neuter substances (carbohydrates); oils, resins, and bitumens; alcohols and ethers; organic acids; and organic alkalis.”

His friend, Dr. George Bacon Wood, from conversations with students reported that Bache’s lectures were slow, deliberate, clear, and methodical. His colleague, Samuel D. Gross, characterized the lectures as dull, and said that the students appeared not to know much chemistry at their final examinations. On the other hand, one of his students claimed that the lectures were “not to be surpassed.” From an examination of the Announcements of 1841 through 1864, there is no indication that Bache had any assistance with his course, although a Demonstrator in Anatomy is listed frequently.

Bache is not known to have conducted any original chemical research. Wood said that Bache had “little of the imaginative or inventive faculty.” His chemical paper of 1811 and three in 1813 were all of a nonexperimental nature, having to do with chemical composition, the laws of chemistry, and chemical nomenclature.

The major contribution of Bache to the chemistry and medicine of his time, other than through the direct impact of his teaching, was by way of his books. He published his System of Chemistry for the Use of Students in Medicine in 1819, edited (with Robert Hare of the University of Pennsylvania) Ure’s Dictionary of Chemistry in 1821, prepared a supplement to Henry’s Elements of Experimental Chemistry in 1823, anonymously edited Cutbush’s System of Pyrotechny in 1825, served as coeditor of the North American Medical and Surgical Journal between 1826 and 1831, took part in revisions of the Pharmacopoeia of the United States in 1830, 1840, 1850, and 1880, coedited (with Wood) the Dispensatory of the United States of America through eleven editions from 1833 to 1864, edited Hare’s Compendium of the Course of Chemical Instruction in the Medical Department of the University of Pennsylvania in 1836, and published four American editions of Turner’s Elements of Chemistry between 1819 and 1841. Smith considered it likely that Bache’s work on the Dispensatory led to his Professorship at Jefferson in 1841. Franklin Bache died on March 19, 1864, just as he was preparing to labor on yet another edition of the Dispensatory.

Benjamin Howard Rand, M.D.
Professor of Chemistry
(1864–1877); Dean (1869–1873)

Benjamin Howard Rand (Figure 4-3) was born in Philadelphia on October 1, 1827, son of a well-known educator of the same name. He graduated
from Central High School in 1839 at the age of twelve, worked and studied independently for four years, then began the study of medicine under Dr. Robert M. Huston. During his last two years he was Clinical Assistant to Professors Thomas D. Mütter and Joseph Pancoast and graduated from Jefferson in 1848. He was named Professor of Chemistry at the Franklin Institute in 1850 and in the Philadelphia Academy of Natural Sciences (1852–1864), Fellow of the Philadelphia College of Physicians (1853), and member of the American Philosophical Society (1868). He was appointed to the Chair of Chemistry at Jefferson in 1864 and “having good business ability” assumed the Deanship as well from 1869 to 1873. His portrait by Thomas Eakins in 1874, the artist’s first commercial work beyond portraits of relatives and friends, is one of the highlights of the Jefferson collection.

Rand’s lectures at Jefferson are said to have met with approval by the students because he emphasized the applied medical aspects of chemistry rather than the theoretical side. Nevertheless, in his textbook, the preface of which states that the book may be regarded as a full set of notes to the author’s lectures at Jefferson, Rand did not depart from the distribution of topics found in the texts of his predecessors, Green and Bache. After the usual review of the essential bases of physics (19 percent of the text), Rand devoted 52 percent of his space to inorganic and theoretical chemistry, with only 21 percent to “organic.” Furthermore, this last category was treated largely from the standpoint of descriptive chemistry and pharmaceutical applications, not from the “physiological” point of view.

In 1866 Jefferson added a summer course to the two five-month-per-year sessions that had been the standard curriculum. Rand lectured on “Applied Medical Chemistry and Toxicology.”

There is no evidence that Rand had any assistance in his teaching until close to the end of his career, when William H. Green, M.D., was listed on the staff as a Demonstrator of Chemistry, and it was stated that Practical Chemistry was taught by the Demonstrator under the supervision of the Professor.

Rand appears not to have conducted any original research, although he contributed to medical journals, in addition to having written An Outline of Medical Chemistry (1855) and Elements of Medical Chemistry (1865), and edited the third edition of Metcalf’s Caloric: Its Agencies on the Phenomena of Nature (1859).

Because of ill health, Rand resigned his Chair and was elected Emeritus Professor in 1877. It is sad to relate that his library of medical and other books was sold in the year following his retirement. He died in 1883.

Robert Empe Rogers, M.D. Professor of Medical Chemistry and Toxicology (1877–1884)

Robert E. Rogers (Figure 4–4) was born in Baltimore on March 29, 1813, one of four sons of Patrick Kerr Rogers. The family seems to have been exceedingly gifted in science; the father and all four sons were scientists or physicians as well as scientists. Robert Rogers received his early education from his father and, after the latter’s death in 1828, from his brothers, James and

FIG. 4–4. Robert Empe Rogers, Professor of Medical Chemistry and Toxicology (1877–1884).
William. His initial professional goal was engineering, but after participating in railroad surveying in 1831 and 1832 he found the work not to his liking. He continued his own studies of botany, geology, and mineralogy, and began medical studies at the University of Pennsylvania under Robert Hare. Rogers received his medical degree in 1836 with a thesis concerning (among other topics) the diffusion of liquids and gases through animal and vegetable tissues and membranes. The thesis was of such quality that it was published as a scientific paper.

Rogers did not practice medicine after graduation. From 1836 to 1842 he was chemist of the first Geological Survey of Pennsylvania (his brother, Henry, a geologist, was head of the survey). He was then appointed Professor of General and Applied Chemistry at the University of Virginia, a position he held until 1842 when he succeeded his deceased brother, James, as Professor of Chemistry in the Medical School of the University of Pennsylvania, also becoming Dean four years later. During the Civil War, in the course of his duties as Acting Assistant Surgeon in the Army, Rogers lost his right hand while demonstrating the operation of a steam mangle in the West Philadelphia Military Hospital. During his tenure at the University of Pennsylvania he advised several of the government mints concerning their metallurgical operations.

In 1874 the University of Pennsylvania was considering a number of changes, such as moving to West Philadelphia from its center city location and lengthening the medical curriculum. Rogers refused to enter the ensuing controversies and, instead, accepted the Chair at Jefferson that had been left vacant by the retirement of Rand. It may be noted, in terms of views concerning age of appointees to academic positions, that Rogers entered into his duties at the age of 64, and served with distinction until the age of 71.

Rogers enjoyed both research and lecturing and performed well in both. He was “a popular teacher, loved and honored by his students, and esteemed by his colleagues of the Faculty.” In 1877–1878, Rogers was assisted in teaching Practical Chemistry by a Demonstrator, George M. Ward, M.D. One of Roger’s major curricular achievements was the establishment of the first student laboratory course in chemistry at Jefferson. This was under the supervision of the Professor, aided by Dr. Ward, who continued in that post through 1886. In 1883–1884, a postgraduate course in Medical Chemistry was listed with the same Dr. Ward as Instructor.

Rogers was the first of Jefferson’s professors of chemistry to recognize the arrival of the era of Physiological Chemistry. While still at the University of Pennsylvania, he edited an American edition of Lehmann’s treatise *Physiological Chemistry,* regarded as one of the most influential books of the era. In this two-volume work, inorganic chemistry occupied but three percent of the total space, descriptive organic chemistry a more usual 28 percent, but 64 percent was devoted to such topics as fluids and tissues, digestion, absorption, metabolism, oxidation, respiration, heat production, and nutrition. The attitude of the more conservative members of the profession toward such an approach can be seen in Holland’s eulogy of Rogers, wherein he stated that the Lehmann treatise “contains much that is usually included in treatises on physiology.”

Although the weighty Lehmann text was recommended as reading material for Rogers’ course (a recommendation not likely to be followed by many students, in view of the size of the work), other smaller and more usual books also were included in the list. These had the common overemphasis on inorganic chemistry and underemphasis on physiological matters. Rogers was doubtless constrained in his choices by the fact that at the time and, indeed, until the early years of the twentieth century there was no requirement of chemistry for admission to the Medical School.

By contrast to some of his predecessors, Rogers was an avid researcher. Most of his research was done prior to his arrival at Jefferson, perhaps to be expected in view of his age at the time of his appointment. While at Virginia and Pennsylvania he published in the fields of inorganic and industrial chemistry, mineralogy, and metallurgy. At Jefferson his interest was in electric generators. Smith lists 20 papers without indication of coauthorship, whereas Ruschenberger lists four papers by Robert E. Rogers alone and 24 more with his brothers or other coauthors. In addition
Rogers published with his brother James A Text Book on Chemistry (1846), based upon earlier British texts.

In June, 1883, Rogers received an Honorary LL.D. degree from Dickinson College. He resigned from his Jefferson Chair a year later due to ill health and was elected Emeritus Professor. He died on September 6, 1884, at the age of 72.

Era of Biochemistry (1880–Present)

The Era of Biochemistry, that is, the period in which biochemistry achieved the status of an independent discipline, dates from 1880 through the present time. Signs of this achievement were the founding of the *Zeitschrift für physiologische Chemie* by Hoppe-Seyler (1877), establishment of the first Chair of Physiological Chemistry in the United States (Chittenden at Yale, 1882), founding of the two leading English language journals in the field (*Journal of Biological Chemistry* [1905]; *Biochemical Journal* [1906]), and organization of the American Society of Biological Chemists (1906 or 1907) and the Biochemical Society, London (1911).

Scientific advances that characterized this era were too many for individual citation. It can be noted, briefly, that the early years of the period saw noteworthy progress in pure chemistry along the lines of electrolytic ionization, radioactivity, osmotic pressure, valence theory, colloids, and polymers. In biological chemistry, great advances were made in the chemistry of carbohydrates, polypeptides, cell-free fermentation, nucleic acids, endocrinology, coenzymes, enzyme kinetics, biological oxidation, nutrition and vitamins, pathways of fermentation, glycolysis, oxidation of fatty acids, and inborn errors of metabolism.

At Jefferson the arrival of the era of Physiological Chemistry was recognized somewhat belatedly, and only by Professor Rogers. The era of Biochemistry, similarly, would make its appearance at Jefferson rather tardily, in the person of Philip B. Hawk. There were, nevertheless, some stirrings even before Hawk’s arrival. In 1880, Drs. Richard Dunglison (Jefferson, 1856; the son of Robley) and Woodbury made the editorial comment that too much time was spent on the elementary aspects of chemistry and that the lengthy laboratory exercises in the analysis of “minerals, ores, and building stones” might better be devoted to the analysis of biological samples; in 1882, they suggested that the teaching of many of the details of chemistry in medical school could be avoided if proper attention were given to premedical education.

John William Mallet, Ph.D., Professor of Medical Chemistry and Toxicology (1884–1885)

Mallet’s stay at Jefferson was brief, through no fault of his or of the college. John William Mallet (Figure 4-5) was born on October 10, 1832, near Dublin, Ireland. His father was an engineer and Fellow of the Royal Society. He was educated in chemistry at the Royal College of Surgeons, in Trinity College, Dublin, and in Göttingen, where

![Figure 4-5. John William Mallet, Professor of Medical Chemistry and Toxicology (1884–1885).](image)
he obtained his Ph.D. degree under the celebrated Wöhler. Mallet came to the United States in 1853, was Assistant Professor of Analytical Chemistry at Amherst in 1854, chemist to the State Geological Survey of Alabama in 1855–1856, and Professor of Chemistry at the State University from 1855 to 1860. He worked for the Confederate Army during the Civil War and made a petroleum survey in Louisiana and Texas for a commercial group in 1865. Returning to the academic world, Mallet was Professor of Chemistry in the medical department of the University of Louisiana (1865–1867), at the University of Virginia (1867–1883), and at the University of Texas (1883–1884). His Jefferson appointment then followed but lasted only one academic year, after which he returned to the University of Virginia.

Mallet conducted much research, mostly in the field of inorganic chemistry, beginning during his college years, and totaling over 100 papers. His reputation in chemistry was attested to by his election to the presidency of the American Chemical Society in 1882. His abilities in research were matched by his skills as a lecturer.

Despite his accomplishments and honors, Mallet seemed to be pursued by misfortune. His move to Texas was motivated by the hope that the climate would be favorable to his son who had tuberculosis. Despite this effort, the son died. Mallet then accepted the Chair at Jefferson vacated by the retirement of Rogers. His personal and scientific possessions, stored temporarily in a Philadelphia warehouse, were destroyed by fire a few hours before the insurance was to take effect. His wife died a few months later. He returned to the University of Virginia, where he remained until retirement in 1908. Mallet died in 1912.

James William Holland, M.D., Professor of Medical Chemistry and Toxicology (1885–1912) and Dean (1887–1916)

James William Holland (Figure 4-6) was born on April 24, 1849, in Louisville, Kentucky, son of Dr. Robert Chappell Holland, a practicing physician. He received his A.B. in 1865 and his A.M. in 1868, both from the University of Louisville, where he studied chemistry and toxicology under J. Lawrence Smith, noted student of Orfila and other famous European mentors. In 1868 Holland graduated from Jefferson, where his M.D. degree was augmented by an honorary Sc.D. degree in 1913. Holland began the practice of medicine in partnership with his father and affiliated himself with the University of Louisville as Assistant Demonstrator of Anatomy. In 1872 he became Professor of Medical Chemistry and Clinical Neurology, later successively occupying the Chairs of Materia Medica, Clinical Medicine, and the Practice of Medicine and Clinical Medicine.

Holland was called upon by Jefferson in 1885 to fill the vacancy left by the departure of Professor Mallet. Two years after becoming Professor of Medical Chemistry and Toxicology, Holland also became Dean of the Faculty, a position he held for four years beyond his retirement from the Professorship. During his tenure Holland was responsible for several significant alterations in the teaching program: In 1888, the requirement of a thesis for the M.D. degree was eliminated for
all students except those aiming at prizes. Oral examinations were replaced by written examinations, and systematic grading of courses was established.  

In the specific area of chemistry, the curriculum was extended to cover two years (Figure 4-7). The first year dealt with inorganic or general chemistry and toxicology. The second year covered organic chemistry and urinalysis or medical chemistry. Student laboratory courses accompanied the lectures in both years. Although the laboratory of the second year brought the student into contact with medically interesting material (e.g., bile, blood, urine, gastric contents), that of the freshman year was primarily an exercise in elementary chemistry, including acidimetry and alkalimetry, followed by toxicological tests for poisons. This part of the curriculum was not received with enthusiasm by the students, as recorded by a class historian: “We dabbled in chemistry and learned how to explode a hydrogen generator while performing the March (sic!) test for arsenic, and incidentally learned how to pay a dollar for the noise, when we got back the remnant of the breakage fee we had deposited at the beginning of the year.” By 1905 the laboratory course of the second year was called Physiological Chemistry and had evolved into the following topics: chemical reactions of starches, sugars, fats, and proteins; chemistry of milk and its coagulation; salivary, gastric and intestinal digestion; and bile, blood and its coagulation. This series with modifications was the basis of the laboratory courses of several of Holland’s successors.

The general outlines and order of priorities in Holland’s lecture course may be surmised from examination of his textbook26 and of the pocket “compend” of Lawrence Wolff, M.D.27, whom Holland recruited from the “German Hospital,” later to be Lankenau Hospital, to be his Demonstrator in lectures and assistant in running the student laboratory. In both, inorganic chemistry was dominant—Holland stated in his

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Fig. 4-7 Professor Holland’s chemistry recitation in West Lecture Room, fourth floor of 1898 College (ca. 1902).
preface that the lack of proper preparation of entering medical students necessitated such coverage plus introductory physics. Holland's concept of medical chemistry, however, eschewed physiological functions and emphasized the applications of chemistry only in its toxicological, therapeutic, and diagnostic uses. Thus, although Holland's text, along with seven percent of its space devoted to physics and 4-8 percent to inorganic chemistry, seemed to have 42 percent designated organic and physiological chemistry, only half of this last category was truly "physiological." Digestion was covered, including laboratory experiments, in 15 pages, enzymes in four pages, and food and nutrition in three. Contemporary textbooks by others, for example, Bunge (who devoted several chapters to each of these topics), more truly reflected the era of "physiological chemistry," if not yet that of "biochemistry."

As seen in the Annual Announcements (from 1885-1886 through 1911-1912), Holland had varying amounts of help in the teaching program. Lawrence Wolff was Demonstrator from 1885 through 1895, when he was succeeded by Albert M. Jacob, who held the position until it was taken by J.P. Bolton in 1902. In 1906, Melvin A. Saylor became Demonstrator and studied medicine while he taught, eventually obtaining his M.D. degree in 1915 and later accepting the Chair of Chemistry at Temple University Medical School. During the years of his tenure Holland also employed a sizable number of Assistant Demonstrators (sometimes with M.D. degrees, sometimes with Bachelor degrees) and Assistants (usually with Bachelor degrees).

Before the arrival of Holland at Jefferson, it is probable that samples requiring chemical examinations were handled by the physicians themselves or turned over to the Professor of Chemistry. Holland established a "service" function for the chemical staff by appointing, in 1889, Henry Leffmann as "Pathological Chemist" on the Hospital staff. Leffmann remained under the aegis of the Chair of Chemistry until 1910, at which time his position was absorbed by the Pathology Department of the Hospital. Leffman, who had graduated from Jefferson in 1869, had a distinguished career as a medical chemist in Philadelphia, having taught at Central High School, The Wagner Free Institute of Science, Pennsylvania College of Dental Surgery, and Woman's Medical College of Pennsylvania. In addition, he was port physician of Philadelphia, coiner of the United States Mint, chemist to the coroner of Philadelphia, and chemist to the Pennsylvania Dairy and Food Commission. He died in 1930, bequeathing in his will $30,000 to Jefferson Medical College.

In addition to his textbook, Holland wrote The Urine and Clinical Chemistry of the Gastric Contents, The Common Poisons, and Milk (1908, with earlier editions under similar titles), The Diet for the Sick (1880), the chapter on urine in the American Textbook of Practical Medicine, the chapter on inorganic poisons in Peterson and Haines' Legal Medicine and Toxicology, and many papers. There is no evidence that he conducted any research in the field of chemistry.

Holland retired from the Chair in 1912 and was named Emeritus but retained the Deanship until 1916. He died in 1922. His portrait, The Dean's Roll Call, was painted by Thomas Eakins in 1899. It depicts Holland reading the names of candidates for the M.D. degree in the Academy of Music. The original belongs to the Boston Museum of Fine Arts, and a copy hangs in Jefferson's Eakins Gallery. A second portrait by Adolph Borie, presented by the alumni at Commencement, June 6, 1910, is located in the Dean's office suite.

Philip Bovier Hawk, Ph.D., Professor of Physiological Chemistry and Toxicology (1912–1922)

Philip Bovier Hawk (Figure 4–8) was born July 18, 1874, in East Branch, New York. He obtained his B.S. degree at Wesleyan University, Connecticut, in 1898, but stayed on an additional two years as assistant to W.O. Atwater, well-known nutritional biochemist, receiving his M.S. degree in 1900. Wesleyan conferred an honorary Sc.D. upon Hawk in 1949. His second M.S. degree was received at the Yale Sheffield Scientific School in 1902, after which he transferred his studies to
Columbia University, where he served as Assistant in Physiological Chemistry to W.J. Gies, obtaining his Ph.D. degree in physiological chemistry and nutrition in 1903. It is interesting that both Chittenden and Mendel at Yale considered their student, Hawk, to be an energetic worker but neither imaginative nor brilliant.

Hawk's first postdoctoral position was that of Demonstrator in Physiological Chemistry in John Marshall's Department of Chemistry at the University of Pennsylvania from 1903 to 1907. During this time Hawk wrote the first edition of his famous Laboratory Manual. From 1907 to 1912 he served as Professor of Physiological Chemistry at the University of Illinois, where he "aggressively recruited students and cranked out research." Nevertheless, Hawk believed that his work did not receive sufficient recognition and in a letter of 1911 to the Chairman of the Department felt moved to state that the number of papers emanating from his laboratory, published and read before scientific meetings, exceeded that of any other laboratory in the country. In 1912 Hawk left Illinois for Jefferson, where he served as Professor of Physiological Chemistry (note the change of title) and Toxicology through 1922. After his departure from Jefferson he became headmaster of a New England preparatory school for boys in 1923, lectured on nutrition at the University of California in the summer of 1924, and founded the Food Research Laboratories in 1925, a connection that he maintained until his retirement in 1958.

Hawk died September 13, 1966, at the age of 92. Hawk participated in the founding of the American Society of Biological Chemists and contributed his services to the American Chemical Society as abstractor and section editor for Chemical Abstracts for 43 years. He was elected to the American Philosophical Society in 1915, and was one of only two Jefferson Professors of Physiological Chemistry or Biochemistry to be mentioned in Lieben's 1935 history of the subject. Mention may be made of Hawk's great interest and ability in tennis, a hobby recognized in a cartoon of Jefferson Faculty printed in the Clinic of 1923. He was lawn tennis champion of Delaware (1905) and Connecticut and Central New Jersey (1907-1909), veteran lawn tennis champion of the United States (1921-1923), and served on various lawn tennis committees (1908-1931). He also wrote a book on tennis, Off the Racket (1927).

Hawk's staff over the years included M.A. Saylor, J.A. Speed, R.M. Biddle, O. Bergeim, J.T. Lcary, H.R. Fishback, C.A. Smith, M. Sillman, J.O. Halverson, and R.J. Miller, in various academic ranks. At the time of Hawk's departure, his staff consisted of Olaf Bergeim, Ph.D., as Assistant Professor, Melvin A. Saylor, M.D., as Associate, and Clarence A. Smith, Ph.D., as Associate. Bergeim and Smith had obtained their doctorates in Hawk's graduate program. Many of the staff had also been graduate students in the program. It is a curious omission that Martin Rehfuss, M.D., who participated in Hawk's researches on digestion, does not appear on the staff in any of the relevant Announcements, although he is listed on the Department letterhead in 1916 as Research Associate and is referred to by Hawk in a letter to the American Philosophical Society as Head of the Department's research staff.

![Philip Bovier Hawk, Professor of Physiological Chemistry and Toxicology (1912-1922).](image-url)
As for the Department’s service function, Henry Leffmann continued as “Pathological Chemist” in the Jefferson Hospital through 1919, with Hawk also being listed as “Physiological Chemist” in the Hospital Pathology Department, beginning in 1913.

Hawk’s educational activities were in three categories: medical, public, and graduate. He continued the two-year medical student curriculum begun by Holland but altered the content. By 1913, admission requirements for medical students at Jefferson included chemistry, taken to mean general or largely inorganic chemistry. To ease the transition from the former lack of this and other prerequisites, a “Medical Preparatory Course” was set up to include, along with physics, biology, German or French, a year of inorganic chemistry. Consequently, Hawk was able to omit this subject from his medical course, although organic chemistry remained part of the curriculum. In any case, the course became much more “physiological,” with emphasis on the subject of nutrition.

The first-year lectures on physiological chemistry were presented by Hawk, and lectures and recitations on organic chemistry and toxicology were delegated to two of his associates. The entire staff was listed as participating in the laboratory course. In the second year, Hawk lectured on clinical chemistry and nutrition, with an associate in charge of recitations; the staff again shared the supervision of the laboratory course. It is interesting that Holland’s textbook was recommended for both first- and second-year courses along with Hawk’s own laboratory manual, although it could have had only limited applicability to the modernized course.

One of Hawk’s major contributions to medical and biochemical education was his laboratory manual, Practical Physiological Chemistry, published by Blakiston (later the Blakiston Division of McGraw-Hill). The first edition of this work appeared in 1907 while Hawk was at the University of Pennsylvania. Apparently, the manual was based upon the laboratory course at Yale, where Chittenden and Mendel gave oral instructions; the shorter time available at Pennsylvania necessitated written directions. The manual has had a long and illustrious history as summarized by Dr. Bernard L. Oser, long-time associate of Hawk. Successive editions appeared rapidly. By the time Hawk took up his professorship at Jefferson, the fourth edition was in print; at the time of his departure, the manual had gone into its eighth edition. With the ninth edition, the authorship became “Hawk and Bergeim,” with acknowledged contributions by Cole and Oser, followed by the twelfth and thirteenth under the authorship of “Hawk, Oser, and Summerson.” Hawk did not actually participate in these last two. Oser took over the complete responsibility for the fourteenth edition, renamed Hawk’s Physiological Chemistry, Edited by Bernard L. Oser 1965.

The chemistry course was well received by the students. Abraham Cantarow, M.D., then a student and destined to become one of the subsequent Chairmen of the Department, later referred to Hawk as “a dynamic, inspiring lecturer, with a remarkable gift for clarity of expression and conciseness of presentation.” In 1916 the students organized the Hawk Bio-Chemical Society, a group photograph of which appeared in the yearbook a year later. Despite their liking for Hawk and appreciation of his ability, various class historians have attested to the difficulty of the course, the discomfort of the “volunteers” who submitted to passage of the Rehfuss tube, and their dislike for certain of Hawk’s staff, one (unnamed) individual being referred to as “the rat.” In some classes the difficulty in passing the course resulted in the appellation “Bustem” Hawk.

Evidently Hawk believed that his researches on digestion and nutrition should not remain hidden from the public in scientific journals. To that end, and at the suggestion of editor Edward Bok, Hawk published a series of articles in the Ladies’ Home Journal. These were rewritten and published as a book in 1919, in the preface of which he acknowledged the financial support of his investigations by the Curtis Publishing Company, Mrs. M. H. Henderson, and Dr. L. M. Halsey. This public acknowledgment was interesting, in view of certain later events. Some years after his departure from Jefferson, Hawk wrote another book for the lay public, mainly concerning obesity and diets.

Hawk set up the first systematic program of graduate education at Jefferson. Shortly after his arrival he requested that a Committee on Graduate Instruction be appointed to supervise the program.
This Committee may properly be regarded as predecessor of the Board for the Regulation of Graduate Studies of many years later, which in turn evolved into the present College of Graduate Studies. It may suffice to note that, from its inception to its demise (1914–1923), Hawk's program turned out eight Masters of Science, four Doctors of Philosophy, and three Doctors of Science in Medicine.

Hawk's graduate program was at once his crowning achievement at Jefferson and his undoing. The latter was chronicled in the minutes of meetings of the faculty and of the Board of Trustees toward the end of 1922. It appeared that Hawk had made secret agreements with several commercial concerns for funds to support five of his graduate students, who, unaware of the sources of their support, performed analyses and other investigations of commercial products. The companies involved were given permission by Hawk to use the results of these investigations as endorsements by him and the Medical College in advertising their products.

Specifically, Dean Patterson had presented to the Board of Trustees on December 11, 1922, evidence concerning Hawk's dealings with the Postum Cereal Company of New York, although from other records additional companies involved were the Chester Kent Company of Boston and the Fleischman Yeast Company. The Board requested that the Faculty meet on this matter and present to the Board its recommendations. The Faculty met on December 15 to hear the Dean's evidence (an exchange of letters between Hawk and the Postum Company occurring during 1921) and a statement written by Hawk. Hawk was then asked to appear for the purpose of making any additional statements. He testified that he had not, at the time, considered his financial arrangements with the graduate students or the company unethical, although he admitted to having no authority to permit the company to use the name of the College in its advertisements. He pointed out, however, that similar arrangements with the Fleischman Company, evidently made previous to those under discussion, had led to no objection.

Toward the end of the interview, Hawk agreed that his arrangement with the Postum Company “appeared unethical and unjustified, and should not have been made.” Hawk was then excused, and after further discussion, the Faculty adopted a resolution which, among other things, recommended that Hawk's “connection with the Institution should be severed.” The Dean presented this resolution to the Board of Trustees at its meeting of December 18, at which time the Board granted Dr. Hawk a hearing. The Board then concurred with the Faculty resolution, and severance of Hawk from the Faculty was carried out.

The indignation of the Faculty and Board at having been “used” was apparent in the original transcripts of the meetings. One wonders whether other factors might have exacerbated the situation. Could not the penalty have been a request to “cease and desist” plus an apology? After all, the “refined” standards of behavior must have been of relatively recent vintage, since the College apparently had permitted the publication, in the Class Book of 1899, of an advertisement for Bailey's Pure Rye Whiskey, “used by the Jefferson Medical College Hospital.” Bernard Oser, who was Hawk's laboratory assistant during those trying times, mentioned other possible influences, such as Hawk's involvement in a “difficult and notorious divorce proceeding,” professional jealousy over the large sums of money coming to a nonclinical researcher, and an “untenable” relationship with Dean Ross V. Patterson.

How persistent were the bitter feelings over this affair were evident from the minutes of a faculty meeting held March 29, 1926, in which it was resolved that papers in which the name of the Institution was used must first be submitted to the head of the Department concerned for his approval. This action was taken in response to a publication, stated as emanating from the “Laboratory of Physiologic Chemistry, Jefferson Medical College,” authored by Philip B. Hawk, Martin E. Rehfuss, and Olaf Bergeim. By 1953, Hawk's feelings in the matter had mellowed, at least for the public record; he wrote to the American Philosophical Society that the City of Philadelphia held a warm place in his heart, that some of his most important professional achievements were accomplished at the University of Pennsylvania and Jefferson Medical College, and that his term of service at Jefferson was particularly satisfying in this respect.

Hawk left in December, 1922. Drs. Bergeim and
Smith completed the 1922–1923 teaching session. Saylor had previously left for Temple; Bergeim and Smith departed in the spring of 1922; and Earl A. Schrader, the last graduate student in the group, remained for a time as Demonstrator under Hawk's successor.

(Max) Withrow Morse, Ph.D., Professor of Physiological Chemistry and Toxicology (1923–1930)

(Max) Withrow Morse (Figure 4-9), who used the name Max only occasionally, was born May 7, 1880, in Dayton, Ohio, the son of a physician. He obtained his B.Sc. and A.M. degrees at Ohio State University in 1903 and 1904, respectively, followed by a Ph.D. degree at Columbia University in 1910. During this period Morse spent his summers in scientific endeavors: He was a research worker in the Lake Laboratory of Ohio State University at Lake Erie (1902–1904); a scientific assistant to the Bureau of Fisheries at Woods Hole, Massachusetts (1904–1907); an Instructor in the Marine Biological Laboratory, Woods Hole (1907–1909); and a research worker in the Harpswell Laboratory at Portland, Maine (1908–1910).

Morse's academic employment had included the following: Instructor in Physiological Chemistry at Cornell University (1906–1907); Instructor and tutor in Physiology at City College, New York (1907–1910); Morgan Professor at Trinity College, Connecticut (1910–1913); Instructor in Biochemistry, University of Wisconsin School of Medicine (1913–1916); Associate Professor of Biochemistry, University of Nebraska College of Medicine (1916–1917); Chemical Pathologist and Director of Chemical Research at the Nelson-Morris Memorial Institute for Medical Research, Michael Reese Hospital, Chicago (1917–1919); and Professor of Biochemistry in the School of Medicine, West Virginia University (1919–1923). He was appointed Professor of Physiological Chemistry and Toxicology at Jefferson in 1923. After his departure from Jefferson in 1930, Morse became investigator and consultant at Rohm and Haas Chemical Company (1930–1933), a member of the Department of Chemistry, New York State Psychiatric Institute (1932–1934), consultant for Lederle and Kalak Companies (1934), and vice-president of Vogelbach Associates. He died on February 19, 1951.

Morse’s election as a first choice from a number of applicants raised high expectations at Jefferson. In addition to the Chair in the College, he also became Physiological Chemist in the Hospital Pathology Department. Although Bergeim, Smith, and Schrader were listed on Morse’s initial staff, Bergeim and Smith left the Department soon after Hawk. Schrader, the remaining member of the Hawk program, seems not to have endeared himself to the students, who described him as having “inherited the repulsive characteristics of his former monarch” (Hawk), taking “all of the joy out of life,” and being “the source of most of our worries.”

Other staff members during Morse’s tenure were
Max Trumper, Samuel T. Gordy, Joseph S. DeFrates, George A. Williams, Lyle M. Nelson, Jr., Joseph M. Looney, Paul H. Roeder, John C. McNerney, David M. Farrel, Avenir Proskouriakoff, and Andrew M. Gehret. In each of the last five years of the period, one junior member of the staff was listed as “chemical resident.”

Morse retained the two-year curriculum that had originated with Holland and continued with modification in content by Hawk. Two lecture series ran in parallel in the first year, one in physiological chemistry and one in toxicology. The laboratory course stressed analytical chemistry and the detection of poisons, along with practical applications of physiological chemistry. Nutrition and applied biochemistry were the topics for the second year, and the laboratory course covered clinical chemistry and nutrition.

As was frequently the case in the history of the Department, student reactions to the new regime were quite favorable at first but became more critical in later years. A “Morse Biochemical Society” was formed, interestingly including Abraham Cantarow, a later Department chairman, as a member from the faculty. Students in these early classes praised Morse’s “sterling quality,” “intellectual ability,” and “friendliness to the students,” and showed appreciation for one of Morse’s innovations in teaching biochemistry, namely exhibiting patients to illustrate metabolic anomalies, although the students bemoaned the lack of a relevant textbook for the first few years (Morse’s book was published in 1925). Later yearbooks, however, began to complain of the immense amount of material in the lecture course, disagreements among laboratory instructors, and the impossibility of completing the required laboratory work in the allotted time. The Class of 1932, hearing of Morse’s imminent retirement, presented him with a gold watch.

Morse’s textbook, *Applied Biochemistry*, which went through two editions (1925 and 1927), was more in consonance with the “era of Biochemistry” or, indeed, with the “era of Physiological Chemistry,” than was Holland’s. There was no attempt to provide a thorough grounding in elementary physics or inorganic chemistry. The introductory chapter covered atomic structure, ionization, pH, blood buffers, and acid-base balance. The second chapter on enzymes also included colloid chemistry, whereas organic chemistry was limited to that relevant to carbohydrates, fats, and proteins. The remainder of the text was devoted entirely to physiological chemistry, primarily digestion, nutrition, and clinical biochemistry. Although up to date in most areas, coverage ranged from poor to none on glycolysis in muscle, alcoholic fermentation, enzyme kinetics, and biological oxidations, topics that were being actively investigated and published by biochemical researchers at the time. Illustrations of chemical apparatus were borrowed with permission of the Arthur H. Thomas Company, a laboratory supply house in Philadelphia, but it was untrue, as maintained in a story circulated among students of the day, that the entire textbook was a rewritten Thomas catalog.

Morse's interests were in clinical medicine and physiological chemistry, experimental morphology and cytology, enzymes, atrophy, chemistry of the integument, reaction of tissues, proteins (especially collagen), clinical chemistry, and transfusion substitutes. He published some half-dozen papers and short notes while at Jefferson.

The statements to follow, quoted verbatim or paraphrased from the minutes of meetings of the Board of Trustees or the faculty, should be regarded solely as allegations, since the records contain no actual evidence of wrongdoing, nor is there any indication that Morse, in contrast to Hawk, was given an opportunity to defend his actions before the faculty.

On December 9, 1929, the College Committee of the Board of Trustees resolved to reorganize the Department and to dismiss Professor Morse. On January 13, 1930, the committee stated that they had “considered a large number of facts bearing upon the pecuniary irregularities of Withrow Morse extending over the entire period of his connection with the Jefferson Medical College, the unsatisfactory conduct of the Department itself, the dissatisfaction of students with the Department, and other facts bearing upon the action taken.” Dean Patterson was given authority to carry out the action of the Board. On January 27, 1930, the faculty approved the action of the Board and instructed the Dean to “communicate this action to Professor Morse, with
discretion as to stating the reasons leading to this action,” and to begin a search for a replacement for the Chair. By March 10, the College Committee of the Board decided that Morse should resign by May 31, and two days later stated that “there continue to be unpleasant matters relating to the present administration of the Department of Chemistry.” On May 28, the Library, Museum, and Journal Committee informed the faculty of the receipt of a gift to the library by Professor Morse of a collection of biochemical reprints with their filing cabinets and of various journals.

Joseph Michael Looney, M.D., Acting Head of the Department (1930-1931)

Upon Morse’s departure, the functions of the Department for the remainder of the academic year were directed by Joseph M. Looney, M.D., who had joined the staff as Assistant Professor in 1926. Although not recognized in the college Announcement as Acting Head (the Professorship was listed in 1930-1931 as “vacant”), Looney referred to himself as Acting Professor for the period, and on May 27, 1931, the faculty recommended that the board recognize Looney as having been Acting Head for the school year 1930-1931. By November, 1930, George R. Bancroft was being considered by the Board’s College Committee as Morse’s successor, and in March of 1931 Bancroft was appointed to take office September 1, 1931.

Looney never was considered for the Chair, possibly because of his junior professional rank. The college may, nevertheless, have overlooked a treasure in its own backyard. Although derided by the students in earlier yearbooks for some hesitancy in speech, and overdevotion to the work of Otto Folin, his mentor in clinical chemistry at Harvard, and caricatured in numerous cartoons, by the time of Morse’s departure the students admitted to having “learned a great deal of Biochemistry of practical value from Dr. Looney.” The students of the following year expressed sorrow at Looney’s leaving.

Joseph Michael Looney (Figure 4-10) was born April 3, 1896, in Somerville, Massachusetts, and obtained his A.B. degree (1916) and M.D. (1920) at Harvard. He was Instructor in Biochemistry at Harvard (1920-1922) and Director of the Research Laboratory at the Sheppard and Enoch Pratt Hospital (1922-1926), after which time he was appointed Assistant Professor of Physiological Chemistry at Jefferson and Chemical Pathologist to the Hospital.

Looney assisted Morse with the second edition of the latter’s textbook. Looney’s work in research greatly exceeded that of his chief. An incomplete bibliography in the Jefferson Archives listed 17 publications in addition to the textbook. His interests were several: methods of clinical chemical analysis, some published with Otto Folin in the early 1920s; anti-pernicious anemia factors in liver, amino acid analyses of proteins in the later 1920s.
and blood gases in schizophrenia, after leaving Jefferson in the 1920s. Looney shared with Hawk the distinction of being cited in Lieben’s treatise on the history of biochemistry.

During Looney’s tenure as Acting Head of the Department, the Morse Biochemical Society became simply the Biochemical Society, then disbanded.

George Russell Bancroft, Ph.D., D.Sc. Professor of Physiological Chemistry and Toxicology (1931-1945)

George Russell Bancroft (Figure 4-11) was born July 7, 1878, in Weymouth, Nova Scotia, and became naturalized in the United States in 1934. He obtained an A.B. degree from Acadia College in 1906 (where he was awarded a D.Sc. in 1934), an A.M. from Yale in 1914, and a Ph.D. from Yale in 1917. He pursued postgraduate studies at the University of Chicago in 1920 and 1924 and at Yale in 1929.

After serving as principal in the public schools of Nova Scotia (1898-1899, 1900-1903, and 1906-1907), Bancroft was Science Master at Halifax Academy, (1907-1913), Assistant Instructor in Chemistry at Yale (1914-1917), Professor of Chemistry and Physics at Transylvania College, Kentucky (1917-1918), Assistant Professor of Organic Chemistry at the University of Kentucky (1918-1920), Associate Professor of Organic Chemistry at West Virginia (1920-1923), Associate Professor of Physiological Chemistry in the School of Medicine at West Virginia (1923-1924), and Professor of Physiological Chemistry at the same institution (1924-1931). His appointment to head the department at Jefferson began in September, 1931.

Initially, Bancroft’s staff consisted of Looney and Proskouriakoff from Morse’s staff. These two were soon replaced by Dr. Lorenz Peter Hansen (trained mainly in organic chemistry) and Thomas Lawrence Williams (a pharmacist), both of whom were destined to remain in the Department during two successive Chairmanships. Until the last few years of Bancroft’s tenure, each Announcement listed a different “physiological chemistry intern” in the Department roster; in most cases the same individual had an identical listing in the Hospital. Bancroft did not appoint any other staff members until 1940-1941, when Proskouriakoff made a reappearance as Fellow in Bacteriology and Chemistry, and in 1944, when Daniel Lamb Turner was named Associate in Physiological Chemistry.

In terms of the Department’s service function, Bancroft was listed as Physiological Chemist in the
Hospital’s Pathology Department from 1931 to 1935, along with various “internes.” Abraham Cantarow appeared initially as biochemist on the Hospital staff in 1933–1934, and by 1935–1936 was listed (without Bancroft) in the Hospital Department of Clinical Laboratories with internes through 1940–1941 and then alone.

Under Bancroft the chemistry course reverted to a one-year parallel series of lectures and laboratories (Figure 4-12). Major topics of the lectures were the chemistry of carbohydrates, fats, and proteins, body fluids, digestion and metabolism, nutrition, endocrinology, and analysis of blood and urine. The laboratory experiments followed the same general scheme, with some emphasis on the use of such instruments as the microscope, colorimeter, spectroscope, and polariscope in their biochemical applications. Students made use of the laboratory manual containing review questions written by Bancroft. The recommended textbook was Mathews’ Physiological Chemistry, one of the most widely used American texts in the early “era of Biochemistry.”

Student dissatisfaction with Bancroft’s course began at its inception and did not cease until his retirement. The chief sources of this discontent seem to have been the large mass of material extraneous to biochemistry that Bancroft incorporated into the course, along with dislike for Bancroft’s staff. Representative complaints: “The rest of our time during the Freshman year was taken up by that one and only Dr. Bancroft and his rat terriers, Hansen and Williams. What a gang and what a course!” “We must admit that ‘Bandy’ was at least sincere and was doing what he believed to be the right thing, whether it was or not.” “Our curiosity was aroused as to why the course had been called Chemistry, since it included from the outset so many other fields, among which were Botany, Astronomy, and GREEK.” These written comments were accompanied by a multitude of unflattering cartoons. It was customary for students to roll pennies down the aisle of the auditorium during his lectures, but he remained oblivious to this protest. With the retirement of Bancroft in June, 1945, an unhappy chapter in the history of chemistry at Jefferson.

Fig. 4-12. Chemistry Laboratory on Third Floor of 1025 Walnut Street College, in 1931.
came to an end. The encyclopedic course in Physiological Chemistry, with liberal portions of etymology, botany, mineralogy, animal husbandry, and metaphysics became a memory.

There is no evidence that Bancroft carried on research during his tenure at Jefferson. Indeed, the administration of the day was cool to such endeavors. Dr. Hansen, who had a lifelong interest in the chemistry of steroids, requested permission of Dean Patterson to construct, at his own expense, a pen for chickens on an unused upper floor of the College building for the purpose of setting up the cockshamb assay for testosterone. The Dean replied: "You are here to teach, not to do research."

Bancroft retired in 1945. At his last lecture the class presented him with a gold watch. He was not elected to Emeritus status.

Abraham Cantarow, M.D., Professor of Biochemistry and Chairman of the Department (1945–1966)

Abraham Cantarow (Figure 4-13) was born January 27, 1901, in Hartford, Connecticut, into a medically oriented family. His father, grandfather, three uncles, and an aunt were in the medical field. After graduation from Hartford Public High School, Cantarow studied for a year at Trinity College and two years at Tufts. While there he took advanced training in violin at the Boston Conservatory of Music, at the same time becoming a top-ranking tennis player. Having decided to study medicine, Cantarow chose Jefferson—an acquaintance pointed out that the textbooks used in most medical schools of the time were written by Jefferson faculty members, and asked, "Why not get your information right from the horse's mouth?"

Cantarow's interest in biochemical research was stimulated by his contacts with Philip B. Hawk, Max Trumper, and Henry Leffmann and its clinical applications by Thomas McCrack and Hobart A. Hare. His roommates have reported that Cantarow finished his day's studies easily and early, then relaxed in the evening with his violin and the music of Bach. This serious music was counterbalanced by his membership in a dance orchestra. Cantarow graduated with honors in 1924.

Cantarow spent his entire professional career at Jefferson. He was, successively, Resident Chemist at Jefferson Hospital (1924–1925), Resident Physician (1925–1927), and Research Fellow in the Department of Diseases of the Chest (1927–1929), and he taught physical diagnosis in that Department (1927), was Assistant to Dr. Harold W. Jones in the Laboratory of Clinical Medicine (1930), and was Biochemist to the Hospital (1931–1945). During this time Cantarow rose in rank in the Department of Medicine from Assistant Demonstrator (1929–1931), to Instructor (1931–1934), Associate (1934–1937), Assistant Professor (1937–1939) and Associate Professor (1939–1945). He was appointed Professor of Biochemistry and Chairman of the Department in 1945.

Many honors were bestowed on Cantarow during his lifetime. Among those most closely
related to Jefferson were the two issues of the
Clinic dedicated to him (1943 and 1959),
presentation of his portrait to the College by the
Class of 1960, Presidency of the Alumni
Association (1964–1965), recipient of the Alumni
Achievement Award in 1968, an honorary Doctor
of Science degree conferred by his alma mater in
1969, and appointment as alumni representative on
the Board of Trustees in 1970.

Cantarow retired as Emeritus Professor of
Biochemistry in 1966 and accepted a post as
Research Planning Officer at the National Cancer

As may be seen from its new title, the
Department of Biochemistry was due to undergo
extensive modernization under Cantarow’s
direction, although at a circumspect and
evolutionary pace. One of the early changes was
the elimination of the service function of the
Department in the Hospital Clinical Laboratories.
Although Cantarow was still listed as Biochemist
or Physiological Chemist to the Hospital in both
1945–1946 and 1946–1947, this listing ceased in
1947–1948. Such a separation of biochemistry as an
independent discipline, divorced from clinical
chemistry, was part of a general trend in the 1940s.

Another of Cantarow’s goals was the
transformation of the Department from its
European format of one “Geheimrat” presenting
all of the lectures and performing all, if any, of the
research, and one or two “dieners” handling the
student laboratory. In the newer pattern the
Department Head shared lectures with several staff
members, who in turn might well be carrying out
independent research. Cantarow inherited from
Bancroft’s staff Drs. Hansen and Turner and Mr.
Williams. Other staff members who appeared over
the years included, in chronological order, Leon
L. Miller, William H. Pearlman, Romano H.
DeMeio, Bernard Schepartz, Robert J. Rutman,
Chiu Tong Ling, F.W. Sunderman, Sr., Leonidas
Levenbook, Milton Toporek, Arthur Allen, and
Sidney Weinhouse, along with several research
associates or research fellows, usually graduate
students. At any given time after the first few
years, the Department consisted of the Chairman
and some half-dozen staff members.

Although for the medical students the course
differed markedly in content from that of
Bancroft, the general format of lectures and
laboratories remained similar for the first few
years. As the Department grew to full strength,
Cantarow began to share the major lectures with
other staff members. During the same period, as
new staff were added, each was given the
opportunity to choose a program of research,
either with the Chairman and his colleagues or
without prejudice to embark on his own line of
investigation.

The lectures were modernized with the
introduction of topics such as bioenergetics,
metabolic antagonism, and biochemical genetics.
Essay-type examinations were eventually replaced
by the multiple-choice format, although these were
graded manually until the advent of the computer.
An experiment in small-group teaching was
instituted in which the staff member with major
expertise would outline the “basics” of the topic to
the entire class, after which the details would be
taught simultaneously in small groups by each of
the staff members. This was abandoned after much
student protest because of the diverse
presentations given by the various staff members.

The laboratory course, which had begun much
as it had been taught under Bancroft, was also
modernized. The “cookbook” experiments that
involved color reactions and some physical
properties of the major constituents of foods and
tissues, together with extensive coverage of blood
and urine analysis, were eliminated. “Problem-
type” experiments were introduced, in which small
groups of students were given a biochemical
problem with several possible alternative
approaches toward its solution, the choice of
which was theirs. Many of these experiments
consisted of the in vitro incubation of tissue
preparations with various substrates, followed by
the determination of changes in amounts of
substances present by the use of paper
chromatography. When possible, cooperative
experiments were organized with the Department
of Physiology in which “physiological”
experiments upon animals were followed or
accompanied by the taking of samples of fluids,
tissues, or excreta for subsequent analysis in the
biochemical laboratory.

Reaction of the students to the course was
generally laudatory except for some unkind
remarks concerning those staff members remaining from Bancroft’s regime. Cantarow’s lectures were uniformly praised, as was his new textbook with Bernard Schepartz, *Biochemistry*, which first appeared in 1954.

In 1949–1950 the Department announced that it would accept graduate students. In 1950–1951 special seminars in advanced biochemistry and a course in biochemical laboratory methods were offered. It was evident that, after the hiatus caused by the departure of Philip B. Hawk, the Department had returned to the twentieth century.

The Department began a course in chemistry for the diploma nurses program and participated in an interdepartmental course in cell biology for entering graduate students. Both courses were carried over into the Chairmanship succeeding Cantarow’s.

In the early years of Cantarow’s Chairmanship, Harrow’s textbook of biochemistry was used, along with the laboratory manual of Hawk and Bergeim. At times the latter served as both text and manual. At other times the Department compiled its own manual similar to that written by Bancroft. Cantarow and Schepartz’s *Biochemistry* (1954) went through four editions, the last in 1967.

Other books written by Cantarow included *Calcium Metabolism and Calcium Therapy* (1931); *Biochemistry in Internal Medicine*, with Max Trumper as senior author (1932); *Clinical Biochemistry*, with Max Trumper (1939) through five editions (1955); *Lead Poisoning*, also with Max Trumper (1944); and *Clinical Endocrinology*, with Karl E. Paschkis and Abraham E. Rakoff (1954). Textbooks for the nurses’ course were written by staff member Milton Toporek.

Research in the Department eventually became more diversified. Cantarow’s interests, which began with calcium metabolism, liver function, and bile pigments, finally turned toward endocrine–cancer interrelationships. This latter course of investigation was pursued with Drs. Paschkis and Rakoff and other members of the interdepartmental Division of Endocrine and Cancer Research.

A Digression; The Cold War, Faculty Dismissals, and Censure

Although the events to be described had many ramifications beyond the Biochemistry Department, their major effect was within this Department and may be included appropriately in its history. As background to this sad period in Jefferson’s history, it should be noted that in the 1950s the elation following the termination of World War II gave way to a pervasive fear of communism in this country as our former ally, the U.S.S.R., began to be perceived as a political threat to the western nations. Anyone advocating so little as American–Soviet friendship was liable to be suspected of harboring more sinister thoughts, particularly during the period in which Senator Joseph McCarthy and the investigations of the House Un-American Activities Committee (HUAC) garnered much publicity.

In this atmosphere institutions of higher learning were required by the State of Pennsylvania to attest to the absence of “subversive” persons on their faculties. The Jefferson Administration never stated that it had such persons on its payroll. Nevertheless, three members were questioned before committees consisting largely of members from the Board of Trustees and Administration concerning their political beliefs and affiliations. The only faculty representative was a Department Chairman. On November 30, 1953, the Executive Faculty voted unanimously that three staff members were “not deemed worthy of holding” their positions. On the same day the Board of Trustees resolved that “employment of each of them hereby is terminated, in the best interests of the institution.” The Dean was empowered to make appropriate settlements. Jefferson agreed to pay each affected individual severance salary to the end of the school year, to provide each with a letter stating that dismissal was not based on a finding of subversion as defined by the Pennsylvania Loyalty Act, and each staff member in turn agreed to sign a release relinquishing all rights to future claims against Jefferson. Thus Jefferson lost two members of the Biochemistry Department and one from the Department of Physiology.

Due to the atmosphere of the time, it became habitual not to discuss “controversial” topics in the hallways for fear of being overheard. One division head of a clinical department, a professor...
of international repute, alleged that he had been threatened with dismissal if he continued to voice his objections to the way in which the affair was handled. The case was reviewed by the American Association of University Professors (AAUP) in 1956. It was noted that two of the staff members would have qualified for tenure under the AAUP 1940 Statement of Principles on Academic Freedom and Tenure, that the dismissals were without charge or explanation, except for the statement concerning "best interests of the institution," and that faculty representation in the hearings was inadequate, as was the severance pay. As a consequence the association placed Jefferson on its "censured" list. Although certain Jeffersonians tended to take this censure lightly, others had the experience of being told at scientific meetings by well-qualified fellow scientists that they would not consider accepting a position at an institution under censure. Largely through the efforts of President Peter A. Herbut, tenure regulations at Jefferson were established that met with the approval of the AAUP, and the school was removed from the censured list in 1968. Not all institutions of higher learning succumbed to the hysteria of the times; the staff members dismissed from the Department of Biochemistry found employment at other universities.

Paul Herbert Maurer, Ph.D.,
Professor of Biochemistry and Chairman of the Department
(1966–1985)

Paul H. Maurer (Figure 4–14) was born in New York City on June 29, 1923. He earned his B.S. degree at City College, New York, in 1944 and his Ph.D. at Columbia in 1950. He worked as research biochemist at General Foods Corporation, Hoboken, New Jersey (1944–1946), Instructor at City College (1946–1951), Research Associate at the College of Physicians and Surgeons, Columbia University (1950–1951), Assistant Research Professor in the School of Medicine, University of Pittsburgh (1951–1954), and Associate Professor of Immunochemistry at the same school (1954–1960), Associate Professor of Microbiology at Seton Hall College of Medicine (1960–1962), and Professor of Microbiology at New Jersey College of Medicine (1962–1966), and was appointed Professor and Head of the Biochemistry Department at Jefferson in 1966. In 1984 Dr. Maurer announced his resignation from the Chairmanship to take effect upon the appointment of a successor.


With the accession of Paul H. Maurer to the Chair, the Department of Biochemistry underwent a marked change in character. Because the Chairman’s major interest was immunochemistry, many of the additional staff members appointed were immunochemists. On the average, the staff in subsequent years consisted of immunochemists and traditional biochemists, including “molecular biologists,” in about equal proportions. This hybrid character naturally also was reflected in the various areas of teaching and research.

In the course for freshmen medical students a sequence of lectures in immunochemistry was added and remained for many years. In 1982–1983 most of this material was moved into the microbiology course of the second year. Members of clinical departments were invited to present biochemical–clinical correlation lectures. After a year or so of discussion, the medical student laboratory course in biochemistry was abolished in 1969–1970, in harmony with a national trend. In the early 1970s remedial programs were set up for students having difficulties with the course, and in the late 1970s the lecture series in nutrition was expanded. The major change in the freshman course, however, occurred in 1972–1973 when an integrated, more properly characterized as “interpolated,” course in Cell and Tissue Biology was established. This combined the former course in Biochemistry with the Histology course of the Anatomy Department, in addition to contributions from several other departments or divisions of larger departments.49

Another innovation occurred in 1975–1976, when the senior medical students were offered a course in the clinical aspects of biochemistry and immunobiology. These fourth-year sessions, which were part of a senior-year elective program, were in the form of small-group seminars and discussions.

For many years the Department had participated in the training of diploma nurses through offering a course that included inorganic, organic, and biological chemistry. This course continued during Maurer’s Chairmanship but was abolished when the diploma program for nurses was phased out in favor of a baccalaureate curriculum by 1982. The Department made a quantitatively greater commitment when, in the 1970s and extending for a decade, courses were offered to baccalaureate nurses and medical technologists in the College of Allied Health Sciences in such subjects as quantitative analysis, general biochemistry, and organic chemistry. These contributions of the Department ended in the early 1980s, when the College of Allied Health Sciences undertook to teach all of its own courses in chemistry.

The interdepartmental graduate-level course in Cell Biology, to which the Biochemistry Department had contributed a significant share, was eliminated in 1972–1973 when the Cell and Tissue Biology course of the medical curriculum became available. Courses offered within the department included a postdoctoral training program in immunochemistry; a series of seminars in biochemistry presented by graduate students, faculty, and guests; an analogous seminar series in immunochemistry; physical chemistry of proteins and enzymes; enzyme cytology; enzymology; special topics in advanced biochemistry; immunochemistry and immunology; bioorganic chemistry; advanced biochemical techniques; research in biochemical oncology; and the usual graduate credits for the students’ thesis research.

The hybrid nature of the Department was recognized formally in 1983–1984 when two separate programs of graduate study were listed: Biochemical Approach to Immunology and Molecular and Developmental Biochemistry. These graduate programs reflected also the divergent research interests of the two groups within the Department.


On July 1, 1985, Dr. Paul H. Maurer resigned his Chairmanship and Dr. Robert C. Baldridge was appointed Acting Chairman. Dr. Baldridge (Figure 4-15) was born January 19, 1921, in Herington, Kansas. He obtained his B.S. degree from Kansas State University in 1943, and an M.S. in 1948 and
a Ph.D. in 1951 from the University of Michigan. Baldridge was Instructor in Biological Chemistry at Michigan from 1951 through 1953 and rose from Assistant Professor to Professor of Biochemistry at Temple University School of Medicine, 1953–1970, where he also became Associate Dean of the Graduate School in 1965. In 1970 he was appointed Professor of Biochemistry and Dean of the College of Graduate Studies at Jefferson, holding the latter position until 1981. Dr. Baldridge’s major research interest centered on amino acid metabolism, particularly in genetic disorders such as histidinemia.

Darwin J. Prockop, M.D., Ph.D., Chairman of the Department of Biochemistry, and Director, Jefferson Institute of Molecular Medicine (1986–)

On July 22, 1985, Dr. Darwin J. Prockop (Figure 4–16) was appointed to the Chair and also named Director of the Jefferson Institute of Molecular Medicine, effective as of April, 1986. Dr. Prockop was born August 31, 1929, in Palmerton, Pennsylvania. He obtained his B.A. degree from Haverford College (1951), an M.A. from Oxford University (1953), an M.D. from the University of Pennsylvania (1956), and a Ph.D. from Washington University (1961). Prockop interned at New York Hospital–Cornell Medical Center (1956–1957), was Resident Fellow in Pharmacology at the National Heart Institute, (1957–1958), and Research Investigator in Biochemistry (1958–1961). He rose through the ranks from Associate in Biochemistry to Professor of Biochemistry and Medicine at the University of Pennsylvania (1961–1972), and was Professor of Biochemistry and Chairman of the Department at Rutgers Medical School from 1972 until his Jefferson appointment. Prockop’s major


FIG. 4–16. Darwin J. Prockop, Chairman of Biochemistry Department and Director of Institute of Molecular Medicine (1986–).
research centered on the metabolism of collagen and other constituents of connective tissue.

The Department of Biochemistry has experienced both lean and fruitful years. The last four decades, however, witnessed expansion in student and graduate programs, increase in research, and progressive enlargement of the staff. The new Institute of Molecular Medicine envisages 18 faculty appointments, extensive laboratory space and equipment, and funding for research activities. The Department is thus poised to exceed its past achievements.

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