3. The Brothers Chandler and *The American Chemist*

One of the most important events in the history of chemistry in America was the founding in 1870 of the journal *The American Chemist* by Charles F. Chandler (1836-1925) of Columbia University and W. H. Chandler (1841-1906) of Lehigh University. It promised to cover "theoretical, analytical and technical chemistry." It was intended to serve the entire chemical community in North America.

3.1 Charles F. Chandler (1836-1925)

Charles Chandler was one of the most significant members of the American Chemical Society and served as President in 1881 and 1889.

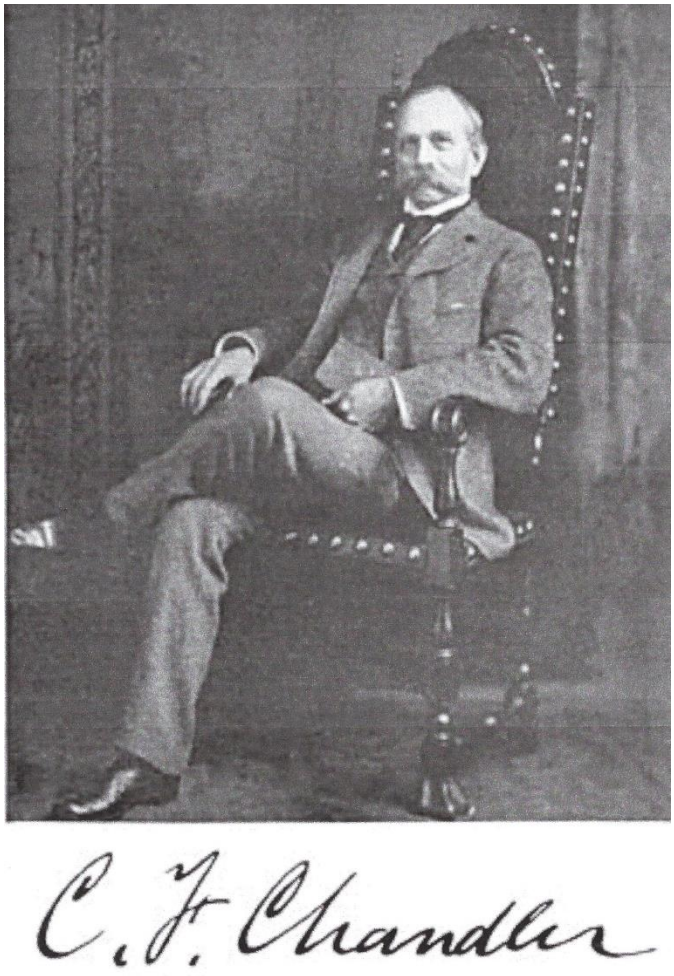

Figure 3.1 Charles F. Chandler

Chandler was born and educated in New England. He entered the Lawrence Scientific School at Harvard in 1853, at a time when notables such as Eben Horsford and Louis Agassiz were there. Such students were not admitted to Harvard and could not take courses from Josiah Parsons Cooke! In order to obtain a professional education in Chemistry, Chandler was advised to go to Europe. He entered the University of Gottingen and worked with Friederich Wohler. In 1855 he proceeded to the University of Berlin and worked with Heinrich Rose. In 1856 he received both M.A. and Ph. D degrees from Gottingen with a thesis entitled "Miscellaneous Chemical Researches." It consisted of an analysis of nine rare minerals. His interest in analytical chemistry and mineralogy continued throughout his life.

Upon his return to the United States, he became a Professor of Chemistry at Union College in Schenectady, New York, upon the appointment of his old friend, Charles Joy, to the Chair of Chemistry at Columbia College, New York. He published one of the first American textbooks on qualitative analysis in 1860. In 1864 he was called to help found the Columbia School of Mines. Upon the death of Charles Joy, Chandler also taught chemistry at Columbia. The bold venture was a resounding success and Chandler was appointed as Dean in 1865.

3.2 William Henry Chandler (1841-1906)

William was educated at Union College and graduated in 1862. He joined his brother at the Columbia School of Mines as an Instructor from 1868-1871. He received a Ph.D. in Chemistry from Hamilton College in 1872. In 1871, he became Professor of Chemistry at Lehigh University. In addition, he became the Director of the Lehigh Linderman Library.

3.3 *The American Chemist*

There were many factors that motivated the Chandlers to start *The American Chemist,* but one of the primary reasons was the discontinuing of the American Edition of the English *Chemical News.* The Chandlers knew that in order for the American chemical community to succeed, there needed to be an open channel for all chemical communications. They deliberately envisioned all aspects of the chemical world. They were especially concerned that industrial chemists have access to the latest advances in experimental chemistry.

The author community included many of the people who founded the American Chemical Society later in the 1870s. The first article to appear in the July, 1870 issue was "Historical Notes on the Defunct Elements" by Henry Carrington Bolton(1843-1903). The history of chemistry was an important part of this publication during its run from 1870-1877.

Another author who appeared in Volume 1 was Frank Wigglesworth Clark (1847-1931). Clarke was one of the founders of the American Chemical Society and served as President in 1901. His paper was entitled "An Examination of the Doctrine of Atomicities." In it Clarke displays his keen and logical mind. He uses specific counterexamples to question specific proposals. He believed in Daltonian atoms and in the existence of chemical bonds, but arbitrary attempts to organize the known compounds all fail in 1870. For example, he demolishes the proposed division of elements into Artiad and Perissad classes (even or odd atomicity) by citing elements that display both even and odd compounds. Clarke's penchant for careful organization and unflinching commitment to demonstrable concepts led him to be named the Chairman of the International Committee of Atomic Weights. He served in this role from 1902 to the end of the First World War.

Clarke was trained at the Lawrence Scientific School under the direction of Wolcott Gibbs(1822-1908). Harvard had two of the most famous American chemists in this era; Josiah Parsons Cooke (1827-1894) was the Erving Professor while Gibbs held the Rumson Chair.

Figure 3.2 Frank Wigglesworth Clarke, ACS President 1901

One of the most decorated chemists in America was T. Sterry Hunt(1826-1892). While he never earned any advanced degree, he was honored with the LL.D. by the University of Cambridge, England and with an M.A. by Harvard. He was elected as a Fellow of the Royal Society of London in 1859, and was elected to the American National Academy of Sciences in 1873. He helped to found the Royal Society of Canada and twice served as its President (1884-5). He served as the President of the American Chemical Society in 1879 and 1888. His lead article in 1870 was on his process for the extraction of copper from its ores. This industrial chemistry was developed in collaboration with James Douglas of Quebec. Hunt served as the Chemist and Mineralogist of the Canadian Geological Survey from 1846-1872. He was Professor of Geology at Massachusetts Institute of Technology from 1872-78.

Figure 3.3 T. Sterry Hunt, ACS President 1879, 1888

Another highly decorated American chemist was John Lawrence Smith (1818-1883). He was the second President of the ACS in 1877. Although he did hold an academic post in Louisville, he is most famous as the leading analytical chemist of America. He published hundreds of articles in the *American Journal of Science* (Silliman's Journal). Smith was elected to the American National Academy of Science in 1872 and Silliman, Jr., wrote his Memoir. He knew "everything" about real chemistry. He served on many governmental Boards and ceremonial events, like the Paris Exposition of 1867. The article in the *American Chemist* discussed in Chapter 2 grew out of his *Report on Industrial Chemistry* prepared for this event. It treated *Potash and its Compounds.* Smith was highly esteemed all over the chemical world.

The next ACS President(1878), Samuel William Johnson (1830-1909), was the leading Agricultural Chemist in America, and helped found the many Experimental Stations. He was educated at Yale, but his real chemical training came in Europe in the laboratories of people like Liebig and Frankland. He returned to become the Professor of Analytical and Agricultural Chemistry at Yale (1855-1895). In addition to his academic responsibilities, he served as the Director of the Connecticut Agricultural Experiment Station from 1877-1899. He was elected to the American National Academy of Sciences in 1866. Since he taught all the forms of Chemistry at Yale, he was concerned with "theoretical" chemistry as well, and published an article on "Chemical Notation and Nomenclature: Old and New" in Volume 1.

Figure 3.4 Samuel W. Johnson, ACS President 1878

Many of the early Presidents of the American Chemical Society also served as President of the American Association for the Advancement of Science(AAAS). George Frederick Barker (1835-1910) served in this role for AAAS in 1879 before he became ACS President in 1891. In Barker's National Academy of Sciences Memoir, Edgar Fahs Smith (1854-1928) recounts with pleasure being taught out of Barker's *Elementary Chemistry,* one of the longest running textbooks of the 19th century. Smith also followed in Barker's footsteps as an electrochemist and an ACS President(1895). The lead article for Volume 1, No. 10, was "On Molecular Classification." This paper is based on a talk given to the AAAS Chemistry Section and is pedagogical in character. The word "molecule" was used in the 19th century in a different way than at present: it was the smallest assembly of atoms that yielded the same properties as the macroscopic sample of the substance. Barker was already very sensitive to the importance of "arrangement" in his discussion of atomic matter. He was also aware of the different types of chemical bonds between atoms. As a recognized expert in "electricity," he made sure to keep charge in view. Barker had a clear and logical mind and brought much to the world of Chemistry. In volume II, No. 1, Barker presents a remarkable discussion of the polyatomic molecules of chlorine, oxygen and nitrogen. It looks like a modern (19th century) discussion before the advent of quantum mechanics; i.e. just like a current elementary text!

While many of the early ACS Presidents were born in the USA, Charles Anthony Goessmann (1827-1910)(ACS 1887) was born and educated in Germany. He received his Ph.D. in 1853 with Frederich Wohler (1800-1882) at Gottingen. Goessmann came to America in 1857 and eventually was appointed Professor of Chemistry at the Massachusetts Agricultural College in 1869. He devoted his scientific life to Agricultural Chemistry. His feature article was "On the Production of Beet Sugar as an Agricultural Enterprise in Massachusetts." If there were chemists engaged in the enterprise, leaders recognized the value of including these groups in the organization.

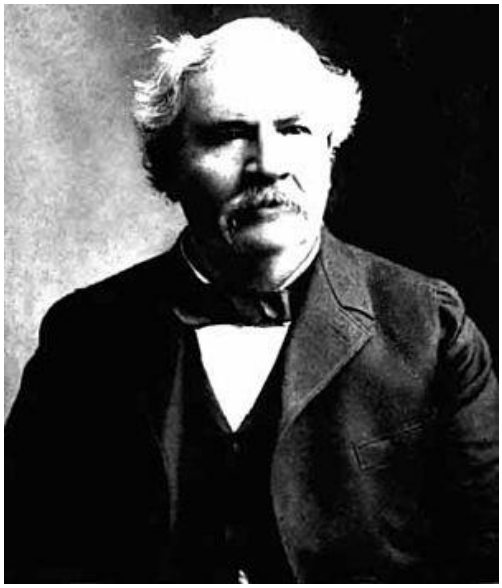

Figure 3.5 Charles A. Goessmann, ACS President 1887

Although Charles F. Chandler received most of the awards, his brother, William H. Chandler, was very active in organizing and promoting chemistry. He published a lead article on "The Peruvian Guano Islands" in the last number for Volume 1.

3.4 Volume II

Although Benjamin Silliman, Sr.,(1779-1864), was one of the most well-known American chemists in the 19th century, he died before the founding of the American Chemical Society. He lived long enough to be in the founding class of the National Academy of Sciences in 1863. His son, Benjamin Silliman, Jr., (1816-1885), was also a founding member of the NAS. One of Junior's most famous articles on the rock oil from Venango County, Pennsylvania appears in Volume II. While he was never elected as a President of the ACS, he played a central role in American chemistry throughout the late 19th century. (see below) One of his roles was as an expert witness, and his article produced for such an occasion, "On Combustion," served as a vehicle for the education of American chemists.

Occasionally, Charles F. Chandler chose to write the lead article himself. He chose as his topic: "A Lecture on Water." In addition to his academic duties, he was the President of the New York Board of Health. He was both fearless and effective in cleaning up New York. But, eventually the corrupt politicians succeeded in blocking his reappointment.

While few American chemists today remember him, Samuel Escue Tillman (1847-1942) played an important role in the 19th century. He brought Chemistry to the military academies and served as President of West Point during World War I. He published an insightful article on "Atoms and Molecules" in Volume II. He also wrote the textbooks, *Descriptive General Chemistry* (1897) and *A Textbook of Important Minerals and Rocks* (1900).

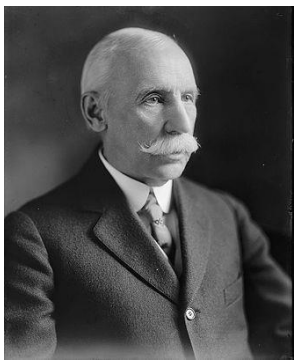

Figure 3.6 Samuel Escue Tillman

3.6 Volume III

One of the most enlightening articles to appear in Volume III is entitled "Fluorescent Relations of Anthracene and Chrysogen," by Henry Jackson Morton (1836-1902). Morton was one of the most interesting American chemists of the 19th century. He produced the first complete translation of the Rosetta Stone while an undergraduate at the University of Pennsylvania. He resurrected the Franklin Institute in Philadelphia by both good management and by delivering public lectures that rivaled those of Faraday at the Royal Institution in London. At the age of 34 he was chosen as the first President of the Stevens Institute of Technology in Hoboken, New Jersey. He built this institution into one of the finest Engineering

Schools in America. Morton became the most recognized chemical fluorescence scientist in the world in this era. He teamed with H. Carrington Bolton to record both the absorption and fluorescence spectra of many uranyl salts. The highly articulated spectra foreshadowed the eventual development of the quantum theory of atomic matter.

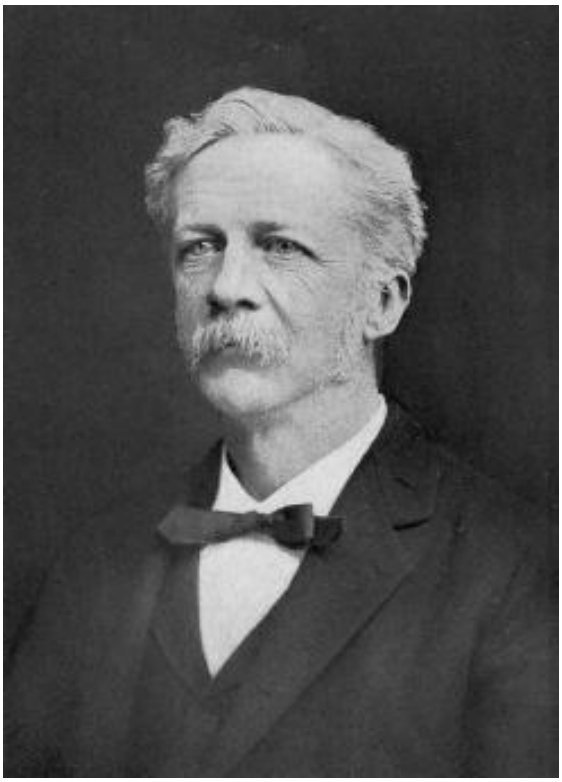

Figure 3.7 Henry Jackson Morton, President of Stevens Institute of Technology

3.7 Volume IV

One of the highlights from Volume IV is the announcement by H. Carrington Bolton of a series of articles on the early literature of chemistry. Bolton's personal library was extensive and contained many rare books. The alchemists of the 17th century were acquainted with "the vital part of air." Cornelis Drebbel prepared such vital air for use in his famous submarine. Drebbel was a real person and served in the courts of both James I of England and Rudolph II of Germany. The second contribution is based on a rare book by Michael Sendivogius (1566-1646): *A New Light of Alchymie* (1604). It discusses, among

many other things, sulfur matches. An even earlier reference can be found in *De Natura Fossilium* (1558) by George Agricola. The third article announces the forthcoming Bibliography for the History of Chemistry. The fourth article focuses on chemical firsts. For example, the first deliberate history of chemistry is attributed to Olaus Borrichius: *De ortu et progressu chemiae* (1668). Volume IV also contains the suggestion by H. Carrington Bolton of a Centennial of Chemistry celebration in 1874, which was heartily seconded by the Editors.

Articles on chemistry by Harvard professors are relatively rare in *The American Chemist,* but a technical note from Eben Horsford (1818-1893), the Rumford Professor, appears in Volume IV. Horsford was an American disciple of Justus Liebig and promoted agricultural chemistry.

The proposal of a centennial meeting was warmly received by the readership of *The American Chemist.* A collection of letters in favor of the event was published in the last issue of Volume IV. Writers included Eben Horsford, S. Dana Hayes, Albert R. Leeds (1843-1902), Rachel Bodley (1831-1888)(Suggested Northumberland), Benjamin Silliman, Jr., and T. Sterry Hunt. The meeting was convened by the Chemical Section of the New York Lyceum of Natural History with a planning committee composed of H. C. Bolton, C.F. Chandler, Henry Wurtz (1828-1910), A. R. Leeds and C.A. Seeley (1826-1892).

3.8 **Volume V**

Volume V opens with a formal invitation to the meeting in Northumberland, PA on July 31, 1874. The list of seconding chemists reflects the general enthusiasm of the chemical community:

George F. Barker, University of Pennsylvania	(P, 1891)
Frederick Barnard, Columbia College	
James C. Booth, United States Mint, Philadelphia	(P, 1883-85)
George J. Brush, Sheffield Scientific School of Yale	
Charles F. Chandler, School of Mines, Columbia College	(P, 1881, 1889)
William H. Chandler, Lehigh University	
Josiah P. Cooke, Harvard University	
Henry H. Croft, University College, Toronto, Canada	

Silas Douglas, University of Michigan
Henry Draper, University of the City of New York
John C. Draper, College of the City of New York
John W. Draper, University of the City of New York (P, 1876)
Frederick A. Genth, University of Pennsylvania (P, 1880)
Wolcott Gibbs, Harvard University
Charles A. Goessmann, Massachusetts Agricultural College (P, 1887)
S. Dana Hayes, State Assayer of Massachusetts
Benjamin S. Hedrick, Patent Office, Washington, D.C.
Joseph Henry, Smithsonian Institution, Washington, D.C.
Eugene W. Hilgard, University of Michigan
Eben Horsford, Harvard University
T. Sterry Hunt, Massachusetts Institute of Technology (P, 1879, 1888)
Samuel W. Johnson, Sheffield Scientific School of Yale (P, 1878)
Charles A. Joy, Columbia College
H.L. Kendrick, United States Military Academy, West Point, N.Y.
Albert R. Leeds, Stevens Institute of Technology
Abram Litton, St. Louis Medical College
John W. Mallett, University of Virginia (P, 1882)
Henry Morton, Stevens Institute of Technology
Henry B. Nason, Rennselaer Polytechnic Institute (P, 1890)
John M. Ordway, Massachusetts Institute of Technology
Ira Remsen, Williams College (P, 1902)
Robert E. Rogers, University of Pennsylvania
Charles A. Seely, New York
Benjamin Silliman, Jr., Yale College
J. Lawrence Smith, Louisville, Kentucky ((P, 1877)
Henry Wurtz, Hoboken, New Jersey

Many of these chemists went on to serve as President of the American Chemical Society (as noted). All of them played major roles in the American chemical community.

Charles Chandler was very involved in the Public Health community in America. He published a major address by Frederick Barnard (1809-1889), the President of Columbia College, on "The Germ Theory of Disease." Barnard was one of the most remarkable men of the 19th century, and combined both a wide view of science with a nuanced view of humanity and religion. Like the modern John Polkinghorne, Barnard was an Anglican(Episcopal) priest in addition to being a famous scientist. They also served as heads of a college. They recognized the uncertainty of human action and sought to find the way through both the scientific maze and the political minefield.

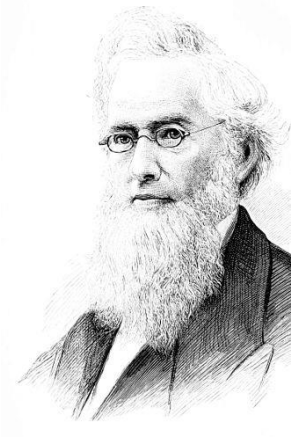

Figure 3.8 Frederick A.P. Barnard, President of Columbia College

A full report of the Northumberland meeting is contained in Volume V. An extensive articulated administration of the meeting was detailed. A letter from John W. Draper apologizes for his absence, but includes well wishes. The Plenary lecture on "The Life and Labors of Joseph Priestley" was given by Henry Croft of Toronto. Priestley was a man of strong opinions and great energy. Eventually, they led him to America. While his own thoughts on the fundamental principles of chemistry were flawed, his knowledge of the facts of chemistry and his clarity in discussion set a good tone for all later American chemistry.

J. Lawrence Smith presented "The Century's Progress in Industrial Chemistry." While any short presentation on this subject is arbitrary, Smith chose important instances. Charles Tennant (1768-1838) developed the process for producing "bleaching powder," dry chloride of lime ($Ca(ClO)_2$). John Roebuck

(1718-1794, FRS) invented the lead-chamber process for making sulfuric acid. Nicholas Leblanc (1742-1806) invented the process for easily producing alkali soda (Na_2CO_3), starting with common salt (NaCl).

Industrial chemistry starts with available natural materials of modest initial cost. Animal fat is readily available. One avenue of processing is to saponify the fat to obtain glycerine and fatty acids. Early work on this process by Michel Chevreul (1786-1889) provided insight into the nature of animal fats and led to the production of a mixture of fatty acids and glycerine. Pure stearic acid could be obtained by crystallization, leaving oleic acid and liquid glycerine. An industrially profitable route to stearic acid was discovered many years later and involved the use of high temperature and pressure water.

Another readily available natural product was coal. While it was often used merely as a source of heat, the "waste products" of coal combustion were soon discovered to be a good source of fuel for gas lights. Another pathway was to subject the raw coal to heating and collect the products: illuminating gas, coke, ammoniacal liquor and "tar." The coal tar is the basis of a vast industry, including pigments and pharmaceuticals.

Benjamin Silliman, Jr., delivered an address on "American Contributions to Chemistry." He starts off by identifying Joseph Priestley as the beginning of modern American Chemistry. The published text of the subject exceeded the oral presentation by at least a factor of 50.

Silliman had a noble vision of Chemistry in its fullness and started the detailed presentation with a discussion of the "Learned Societies." The American Academy of Arts and Sciences (AAAS) was founded in Boston in 1780. The Connecticut version was established in New Haven in 1799. Benjamin Franklin (1706-1790) founded the American Philosophical Society in Philadelphia in 1743.

The published article contains many biographies and starts off with Franklin, Count Rumford (Benjamin Thompson, 1753-1814) and Joseph Priestley. Benjamin Franklin and Joseph Priestley were united by Priestley's "History of Electricity." The importance of electricity in the world of Chemistry is very

American. Rumford attended Harvard and fell in love with chemistry and physics under the spell of John Winthrop, a famous descendent of John Winthrop, Jr., FRS, (1606-1676), the founder of American chemistry. Rumford was an international figure (hence the Count) and founded the Royal Institution in London. He made major contributions to both Thermodynamics and Chemistry. He even married Madame Lavoisier. He donated $5,000 to the Boston AAAS to endow a Prize in honor of researches in light and heat.

The first occupant of the Erving Chair of Chemistry at Harvard was Aaron Dexter (1750-1829). Rumford also endowed a Chair, but directed that it be for "useful arts." The first four holders of the Rumford Chair were Jacob Bigelow (1787-1879), Daniel Treadwell (1791-1872), Eben Horsford (1818-1893) and Wolcott Gibbs (1822-1908). The Rumford Professor served in the Lawrence Scientific School at Harvard.

Gradually colleges installed Chairs of Chemistry as part of the Arts faculty. Princeton (The College of New Jersey) chose John Maclean (1771-1814) as its first Professor of Chemistry in 1795. Maclean accepted the Chemistry Chair at William and Mary College in Williamsburg, Virginia in 1812. William and Mary had a Professor of Chemistry and Natural Philosophy, The Right Reverend James Madison (1749-1812), who also became President of the College. (the other James Madison was a cousin) At The University of Pennsylvania John Ewing (1732-1802) served as Professor of Natural Philosophy and Chemistry from 1779-1801. Bowdoin College appointed Parker Cleaveland (1780-1858), who served from 1805 to 1858.

Chemistry was a recognized subject in Medical Schools going back to German universities in the 16th century. Benjamin Rush (1746-1813) was Professor of Chemistry in the University of Pennsylvania from 1769. James Woodhouse (1770-1809) succeeded him from 1795-1809. Aaron Dexter was Professor of Chemistry and Materia Medica at Harvard from 1783-1816. He was succeeded by John Gorham (1783-1829). Samuel Mitchill (1764-1831) was elected Professor of Chemistry and Natural History at Columbia College in 1792 and founded the medical school. He held an M.D. degree from the University of Edinburgh. He also taught at the College of Physicians and Surgeons of New York

from 1806-1826 and helped to found the Rutgers Medical College of New Jersey. Mitchill also founded the *New York Medical Repository* in 1798.

American chemists, including Mitchill, were devoted to mineralogy and in 1810 Archibald Bruce (1777-1818) founded *The American Mineralogical Journal.* The unfortunate passing of Dr. Bruce was lamented in the first issue of Benjamin Silliman's (1779-1864) *The American Journal of Science* in 1818. The *Journal of the Franklin Institute* was founded in 1826 and survives to the present. *The American Chemist* was founded in 1870, as noted above, and ceased with the founding of the *Journal of the American Chemical Society.*

Silliman, Jr., discusses the Oxyhydrogen blowpipe invented by Robert Hare (1781-1858) of Penn, and improved by his father, at some length. The American Academy of Arts and Sciences of Boston awarded this device the first Rumford Prize in 1839. Hare also made major contributions to electrochemistry. Michael Faraday greatly admired the work of Hare. He was the most prolific author in *The American Journal of Science,* with more than 150 papers. Hare was also a life member of the Smithsonian Institution and donated his many chemical and physical instruments to them upon his death in 1858.

Silliman, Jr., also memorializes his father, Benjamin Silliman (1779-1864). Unlike many of the Professors of Chemistry in America in the early 19th century, Silliman was fully educated in America. He was chosen to become the Chemistry professor at Yale before he became a chemist! He obtained his knowledge of chemistry from John Maclean of Princeton, from Robert Hare in Philadelphia and from James Woodhouse at Penn. He had a systematic mind and produced a successful chemistry text based on his lectures at Yale: *First Principles of Chemistry* (1846). (My copy is the Forty-sixth Edition of 1859!). Silliman was one of the many editors of an American Edition of William Henry's *The Elements of Experimental Chemistry.* (My copy is a Philadelphia edition of 1817.)

Chemists were needed at the U.S. Mint in Philadelphia and Joseph Cloud (1770-1845) was appointed by George Washington and served from 1797-1836. He made many studies of metallic alloys, such as palladium-gold.

William James MacNeven (1753-1841) brought the rigor of European medicine (M.D., Vienna, 1784) to America. He taught at both the New York College of Physicians and Surgeons (1807-1826) and helped found The Rutgers Medical College. He also published a celebrated article on the "Atomic Theory of Chemistry" in 1820 in Thomson's Annals of Philosophy. He is still claimed as the "Irish Father of American Chemistry."

The 19th century got off to a good start at Harvard, where John Gorham, M.D., (1783-1829), was the Erving Professor of Chemistry. He was educated at Harvard (BA, 1801, M.B., 1804, M.D., 1811). He apprenticed as a medical doctor with John Warren in Boston, a tradition at Harvard since its founding. In addition, he studied with Frederick Accum (1769-1838) in London and Thomas Hope (1766-1844) in Edinburgh. His major contribution to chemistry in America was his magisterial *The Elements of Chemical Science* (1819). Silliman calls this the first serious treatise on chemistry by an American author, and was still worth reading in 1874. (It is still worth reading in 2021.)

By 1874, American chemistry was practiced all along the Eastern seaboard. The Professor of Natural Philosophy, Mathematics, Chemistry and Mineralogy at Bowdoin College, Maine was Parker Cleaveland (1780-1858). He was educated at Harvard (1799). He was especially devoted to minerals and published a celebrated treatise on *Mineralogy and Geology* (1816, 3rd Ed. 1856). A nice review of this book appeared in the first volume of the *American Journal of Science* (1818).

Figure 3.9 Parker Cleaveland, Bowdoin College

Harvard also produced the chemistry professor at Dartmouth College, James Freeman Dana (1793-1827). He served as an assistant to Gorham and graduated in 1813. He was then sent to England, where he studied with Accum and bought chemicals and equipment for Harvard. Upon his return he continued his medical studies and was graduated M.D. in 1817. He was appointed to Dartmouth in 1817. Dana was very industrious and published many papers before his death. He published his lecture notes as well.

Another famous Dana was Samuel Luther Dana, M.D. (1795-1868). He graduated from Harvard in 1813, and, after serving in the War of 1812, became M.D. in 1818. He devoted himself to "technical chemistry" and became an expert on "calico printing." Like John Mercer in England, Dana exploited the mordant properties of cow manure! He also wrote the legendary *Muck Manual for Farmers* (1858). Silliman eulogizes him: "Dr. Dana, in point of time, originality, and ability, stood deservedly first among scientific writers on agriculture in the United States."

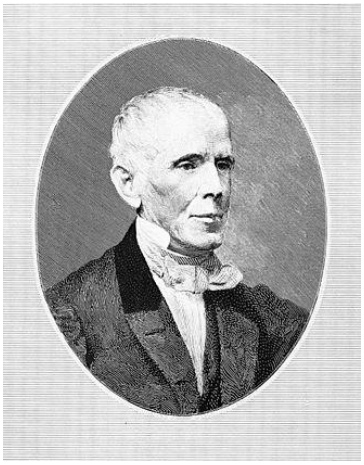

Figure 3.10 Samuel Luther Dana, Agricultural and Consulting Chemist

When Joseph Priestley immigrated to America he was accompanied by Thomas Cooper (1759-1839). Cooper settled in Northumberland, but in 1811 was appointed Professor of Chemistry at Dickinson College in Carlisle, Pennsylvania. His expertise in chemistry soon led to his election as Professor of Chemistry, and eventually President, of the University of South Carolina. He was a very active laboratory chemist. In America, Cooper edited Thomas Thomson's *System of Chemistry* (1818).

Another of the early Professors of Chemistry at Penn was Dr. John Redman Coxe (1773-1864). Coxe was educated at Edinburgh and interned in London. He battled the "yellow fever" alongside Dr. Benjamin Rush in Philadelphia in 1793. He taught in the Medical School at Penn from 1809-1835. One of his most famous papers appeared in Thomson's Annals of Philosophy (1816). A brief quotation reveals that Coxe was thinking about electricity and its uses:

> I have contemplated this important agent (electricity) as a probable means of establishing telegraphic communications with much rapidity as, and perhaps less expense than, any hitherto employed.

James Cutbush (1788-1823) was Professor of Chemistry at the U.S. Military Academy at West Point. But, he achieved considerable notoriety during his years in Philadelphia and his Presidency of the Columbian Chemical Society. He made pyrotechnics a specialty!

In the 19th century, many state universities included a Professor of Chemistry. In Maryland, Julius T. Ducatel (1796-1849) served in this position. He was educated in Paris with Brougniart, Brochant and Gay-Lussac. He also taught in the medical school and published *Manual of Practical Toxicology* (1833).

Lardner Vanuxem (1792-1848) was educated at the Ecole des Mines in Paris. He served as Chair of Chemistry and Mineralogy at South Carolina College in Columbia, S.C. from 1819-1826. He spent the rest of his life exclusively in the study of geology and mineralogy. He developed the finest mineral collection in America, which now resides at Rhodes College, Memphis, Tennessee. Vanuxem was one of the founders of the American Association for the Advancement of Science in 1847.

The first Professor of Chemistry at the University of Virginia was Dr. John Patten Emmet (1796-1842). He obtained his M.D. at the College of Physicians and Surgeons in New York in 1822, and practiced in Charleston, South Carolina until his appointment at the University of Virginia in 1825.

Not many Americans were elected as Fellows of the Royal Society of London in the 18th century. But, Alexander Dallas Bache (1806-1867), the Professor of Natural Philosophy and Chemistry at the University of Pennsylvania,

was so honored in 1860. Bache went on to help found the American National Academy of Sciences and served as its President from its founding in 1863 to his death in 1867. He is most famous for his work as Superintendent of the United States Coast Survey (1843-1867), but he brought his chemical perspective to everything he did.

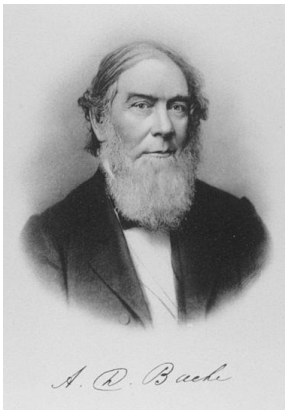

Figure 3.11 Alexander Dallas Bache, FRS, President of the National Academy of Sciences (1863-1867)

Many American chemists of the 19th century were born poor, but were enterprising and ambitious. Evan Pugh (1828-1864) rose to become President of Pennsylvania State University. He paid his way to Europe and earned a Ph.D. with Frederich Wohler at Gottingen. He was interested in the chemistry of plants and made major contributions to this area in his short life.

Figure 3.12 Evan Pugh, President of Penn State University

One of the most important figures to appear in the list of notables in the announcement of the Northumberland Meeting was Joseph Henry (1797-1878), of the Smithsonian Institution. While he is memorialized mostly for his work in electricity and magnetism, the unit of inductance is the Henry, he taught chemistry and carried out significant work on the atomic constitution of matter. He considered himself a natural philosopher and engineer. Silliman understood the importance of Henry in the history of American chemistry.

Figure 3.13 Joseph Henry, Secretary of the Smithsonian Institution

One of the features of the Silliman roster of chemists is a full listing of their publications up to 1874. John William Draper (Chapter 2) was exceedingly prolific.

James C. Booth (1810-1888) worked at the U.S. Mint in Philadelphia. He graduated from the University of Pennsylvania in 1829. He also worked with Friedrich Wohler in Hesse-Cassel. He was one of the most respected analytical chemists in America and founded a commercial laboratory in Philadelphia. Booth served as President of the ACS in 1883 and 1884. He was memorialized by Edgar Fahs Smith in a biography (1922).

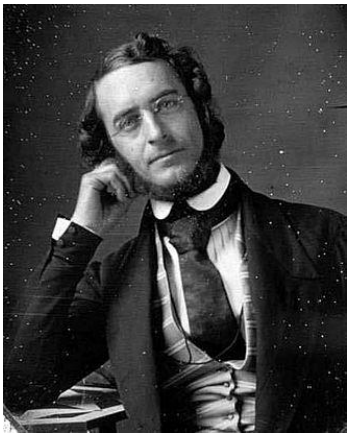

Figure 3.14 James Curtis Booth, ACS President 1883-85

One of the most prominent chemists in America in 1874 was Wolcott Gibbs (1822-1908) of Harvard University. He was educated at Columbia College and graduated in 1841. He also obtained an M.D. from Columbia University College of Medicine in 1845. He obtained further education in Europe with Heinrich Rose, Justus von Liebig, Auguste Laurent, Jena-Baptiste Dumas and Henri Victor Regnault. After serving as Professor of Chemistry at the Free Academy in New York, he became the Rumford Professor at Harvard in 1863. Gibbs was a founding member of the National Academy of Sciences and served in many roles, including President from 1895-1900.

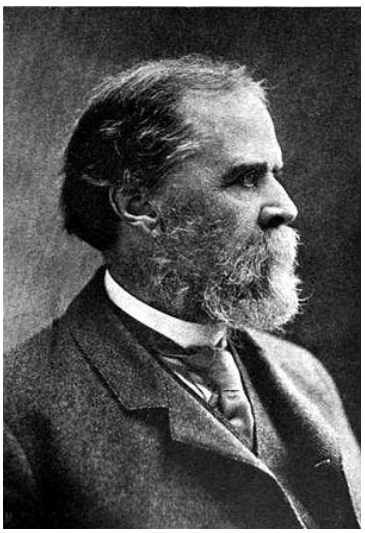

Figure 3.15 Wolcott Gibbs, Americas leading Chemist in 1874.

Robert E. Rogers (1813-1884) was one of the leading chemists in Philadelphia in the 19th century. He studied under Robert Hare at the University of Pennsylvania and received his M.D. in 1836. He returned to Penn in 1852 as Professor of Chemistry. In 1877 he joined the Jefferson Medical College in Philadelphia as Professor of Chemistry and Toxicology. He was one of the incorporators of the National Academy of Sciences in 1863. He played many roles in Philadelphia, including being a Fellow of the College of Physicians and Surgeons and President of the Franklin Institute.

Figure 3.16 Robert Empie Rogers, Philadelphia physician and chemist

James Lawrence Smith (discussed in chapter 2) was one of the most prolific American authors on chemistry in the 19th century. His classic book, *Mineralogy and Chemistry, Original Researches,* (1873), is still worth reading. Smith was one of the best known Americans in Europe and was fully international in his views of chemistry.

Frederick Augustus Genth (1820-1893) was Professor of Chemistry at the University of Pennsylvania. He was born in Germany and studied with Liebig at Giessen. He obtained his Ph.D. under Bunsen at Marburg in 1846. He was appointed Professor at Penn in 1872. He was elected to the National Academy of Sciences in 1872 as well. He maintained a private laboratory in Philadelphia in addition to his other work, including with the Geological Survey of Pennsylvania. He served as President of the American Chemical Society in 1880.

Figure 3.17 Frederick Augustus Genth, President of the ACS 1880

Eben Norton Horsford (1818-1893) taught agricultural chemistry in the Lawrence Scientific School at Harvard. He received his Bachelor of Natural Science Degree from Rensselaer School in 1838. He studied with Liebig in Germany and became his leading disciple in America. He was appointed to the Rumford Professorship in the Lawrence Scientific School in 1847. He is most famous for his formulation of baking powder (calcium acid phosphate) and he founded the Rumford Chemical Works to produce it.

Figure 3.18 Eben Norton Horsford, Rumford Professor at Harvard

John William Mallett (1832-1912) was Professor of Chemsitry at the University of Virginia. Mallett was born in Ireland and obtained his B.A. from Trinity College, Dublin. He studied with Liebig in Germany and obtained his Ph.D. in 1852. He immigrated to the United State in 1854, and even fought for the

Confederacy, but never became a citizen. He taught at many schools, but mostly at the University of Virginia. He was a Fellow of the Royal Society, but was never elected to the American Academy! His chemical interests were very broad and he made major contributions to many areas. He determined the atomic weight of lithium to four places and was within experimental error of the modern value (6.943).

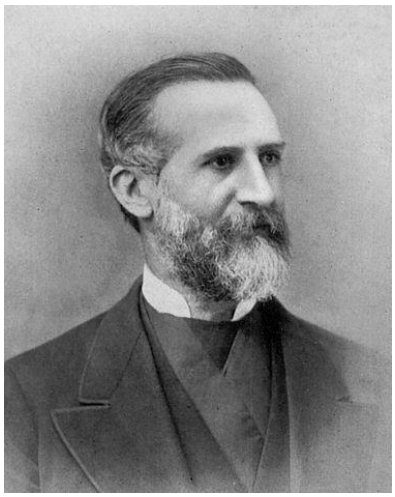

Figure 3.19 John William Mallett, FRS

George Jarvis Brush (1831-1912) was the Director of the Sheffield Scientific School at Yale. He received a Ph.D. from Yale in 1852. He also studied in Europe at Munich and Freiburg and in England at the Royal School of Mines. He was the curator of the Peabody Museum of Natural History at Yale. He was also Professor of Metallurgy and Mineralogy in the Sheffield School. He served as President of the American Association for the Advancement of Science in 1881. He was the leading American mineralogist of the late 19th century. He was elected to the American National Academy of Sciences in 1868.

Figure 3.20 George Jarvis Brush, Director of the Sheffield Scientific School at Yale

Charles Arad Joy (1823-1891) was Professor of Chemistry at Columbia University. While he graduated from Harvard Law School, he chose to go to Europe to study chemistry and received a Ph.D. from Gottingen. He had many interests and served on the juries of many world's fairs. He was the editor of *Scientific American!* He was a great popularizer and published many articles in *Popular Science Monthly.*

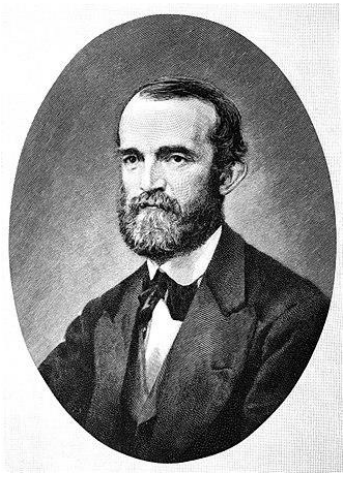

Figure 3.21 Charles Arad Joy, Chemistry for all!

The American Chemist was a great source of information about world chemistry. An extensive article on Japanese Coal appeared in the October issue. It was translated from Japanese by Henry S. Monroe.

One professional position for a chemist was as State Assayer. An important article by S. Dana Hayes , the Massachusetts State Assayer, appeared as well. It discusses adulteration of alcohols and commercial glues. This long-running series was a regular part of *The American Chemist.* It appears that the Assayer's job was also dangerous: Hayes disappeared without a trace in 1876.

The American Chemist also published the record of the American Association for the Advancement of Science meeting for 1874. A plenary lecture by T. Sterry Hunt on Municipal Sewage was reviewed.

Major articles of universal interest were published by authors of world reputation. Frederick Field (1826-1885) was the recognized expert on "Parafffine." He was educated under A.W. Hoffmann at the Royal College of Chemistry in Oxford Street. He was a founding member of the Chemical Society of London and was elected FRS in 1863. He was an industrial chemist with his own firm, J.C.&J. Field, Ltd.

This article was timely. Paraffine is a pure, saturated hydrocarbon. There are paraffins of many molecular weights, and they are highly crystalline, with a low melting point. (Perchance, I have studied such substances from pentane to C200.)

Plenary addresses of many societies were also published. A famous one by Professor A. Crum Brown (1838-1922), FRS, was given to the Chemical Section of the British Association for the Advancement of Science. Brown presented a fully nuanced discussion of the development of chemical structure theory. Rather than "siding" with a particular former chemist, Brown unified the actual facts of the case and produced the arguments that lead to a sound understanding of chemical structure.

The long article by Silliman was continued in the December issue. Josiah Parsons Cooke (1827-1894) was the Erving Professor of Chemistry at Harvard University. The biographical notes constitute a nomination for the National Academy of Sciences, to which he was elected in 1872. I. Bernard Cohen called him "the first university chemist to do truly distinguished work in the field of chemistry." He made major contributions to the systematic study of the elements and measured many atomic weights with high precision. His *First Principles of Chemical Philosophy* (1868) is still worth reading and anticipated the eventual development of the period table by Mendeleev.

Figure 3.22 Josiah Parsons Cooke, Most distinguished American chemist

Matthew Carey Lea (1823-1897) was another outstanding Philadelphia chemist. He was one of the leading American photographic chemists and published hundreds of articles. He was elected to the National Academy of Sciences in 1895. Lea is also known as the Father of Mechanochemistry.

Henry Bradford Nason (1831-1895) was Professor of Natural History at Rensselaer Polytechnic Institute in Troy, New York. He received his Bachelors degree from Amherst College in 1855. He then studied at Gottingen and received a Ph.D. in 1857. He also studied with Bunsen at Heidelberg. He was an inveterate traveler and harvested specimens all over the world. He was President of the American Chemical Society in 1890.

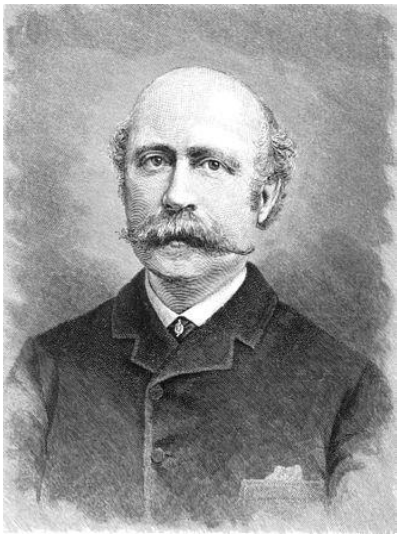

Figure 3.23 Henry Bradford Nason, President of the American Chemical Society

Francis Humphreys Storer (1832-1914) was a Harvard product and Harvard Administrator. He studied with Josiah Parsons Cooke at the Lawrence Scientific School and became one of America's leading agricultural chemists. He served as Professor of Industrial Chemistry at the Massachusetts Institute of Technology before returning to Harvard as Dean of the Bussey Agricultural Institution. He was a good friend of Charles Eliot (future President of Harvard) and married his sister. Storer was very prolific and completely mastered analytical chemistry, as evidenced by his *Cyclopedia of Quantitative Analysis* (1870).

James Mason Crafts (1839-1917) was one of the most active organic chemists in America. He was educated at Harvard and graduated in 1858. He spent the next seven years in Europe with stops in Freiberg, Heidelberg and Paris. Upon his return to the United States he was appointed as the first Professor of Chemistry at Cornell University in 1868. He then went to the Massachusetts Institute of Technology. But, the lure of research drove him back to Paris to work with Charles Friedel, with whom he published many papers. He returned to MIT in Boston in 1891 and eventually served as President. He spent the last 17 years of his life in pure research. Organic chemists will recognize him as one of the authors of the Friedel-Crafts reaction!

Figure 3.24 James Mason Crafts, Friedel's best Friend

Joseph Wharton (1826-1909) was a famous Philadelphia industrialist: Bethlehem Steel! He also founded Swarthmore College and the Wharton School of Business at the University of Pennsylvania. He was privately educated and studied chemistry in the Philadelphia laboratory of Martin Hans Boye (1812-1907). (A nice biography of Boye appears in *Chemistry in America* by Edgar Fahs Smith.) In 1853, Wharton joined the Pennsylvania and Lehigh zinc Company in Bethlehem, Pennsylvania. In 1863 Wharton sold his zinc interests and starting manufacturing nickel. He was fabulously successful and produced most of the nickel in the United States. He also invested in the Bethlehem Iron Company and in 1886 he started producing forged steel. With all his industrial interests, he also published several important scientific papers on subjects like the "red sky" due to Krakatoa and the Doppler effect on starlight! Silliman envisioned the full world of chemistry and Wharton is a great example.

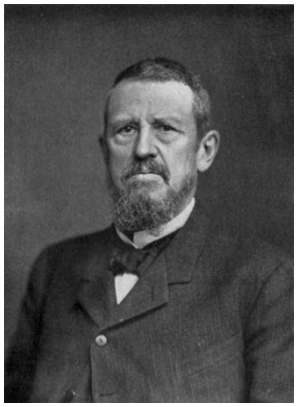

Figure 3.25 Joseph Wharton, Premier Quaker Industrialist and Scientist

Albert R. Leeds (1843-1902) was Professor of Chemistry at Stevens Institute in Hoboken, New Jersey. He was also the first Secretary of the New Jersey State Board of Health. He initially opposed the formation of the American Chemical Society at the Northumberland meeting.

Ira Remsen (1846-1927) was one of the most famous chemists in America, but in 1874 he had just gotten started. After earning an M.D., he studied with Wilhelm Rudolph Fittig (1835-1910) in Gottingen and earned his Ph.D. in 1870. Upon his return to the United States in 1872 he joined Williams College. He wrote the insightful book, *Principles of Theoretical Chemistry* (1877). He was chosen to help found Johns Hopkins University by Daniel Coit Gilman (1831-1908) in 1876. *The American Chemist* ceased publication in 1877, after publishing the *Proceedings of the American Chemical Society* for two years. In 1879 the ACS started publishing *The Journal of the American Chemical Society.* In the same year Remsen started The American Chemical Journal, which he edited for 35 years. At that point the journal merged with JACS.

Ira Remsen became President of Johns Hopkins in 1901and served until he retired in 1912. He served as ACS President in 1902. He was elected to the National Academy of Sciences in 1882 and served as President from 1907-1913. He set a standard for chemical science in America that served the ACS well. He was given almost every honor available for a scientist in his time.

Figure 3.26 Ira Remsen, President of Johns Hopkins, the NAS and the ACS

Henry Wurtz (1828-1910) was a peripatetic American chemist. He graduated from Princeton in 1848 and then studied at Harvard in the Lawrence Scientific School. He was an instructor at the Sheffield Scientific School at Yale and worked for the Geological Survey of New Jersey. He was a Professor at the National Medical College in Washington, D.C. and later worked in the patent office. At one point he worked for Thomas Edison. He published many scientific papers, but his specialty was industrially important processes.

Volume V also continued the series of articles by H. Carrington Bolton: "Notes on the Early Literature of Chemistry." He surveyed many "definitions" of Chemistry from Paracelsus to the 1874 edition of Webster's Dictionary. This article should be required reading for all historians of Chemistry. (pp 215-216).

In the January, 1875 issue a major Address by Adolphe Wurtz (1817-1884), President of the French Chemical Society, was reprinted in English. It was entitled "The Theory of Atoms in the General Conception of the Universe," and led to the publication of his magisterial book, *The Atomic Theory* (English Edition 1880). There was no excuse for any American to claim ignorance of the best thought on this subject, but many, like T. Sterry Hunt, continued to believe and promote nonsense.

Benjamin Silliman, Jr., was interested in many industrial processes and published an announcement of his development of a method of purifying illuminating gases. Rather than just discarding the ammonia commonly found in commercial gases, he found a way to separate and save pure ammonia. This resulted in a patent (No. 153,727).

There were jobs for analytical and consulting chemists in most large cities in America. One of these chemists, Isidor Walz , was a regular advertiser in *The American Chemist.* He immigrated to America to attend Columbia College, but returned to Germany for his Ph.D. at Heidelberg in 1867. He became a naturalized citizen of the United States in 1868. He published an extensive article in the February, 1875 issue on "The Theory of Solubility." He was interested in explaining the phenomenon of solution in terms of the heat of solution and the physical properties of the solution, such as the boiling point and vapor pressure.

He appreciated the contributions of Hermann Kopp (1817-1892) to our understanding of solutions. Walz understood that liquids are highly mobile on a microscopic scale, and that diffusion was one of the processes that led to solubilization. He considered the local interactions of all species in a binary mixture on a molecular level.

One of the most remarkable articles to appear in Volume V was by Mary F. Reed, Assistant in Chemistry in the Laboratory of the Worcester Free Institute of Industrial Science: "Study of the Quantitative Effect of Temperature in the Reaction of Oxalic Acid Upon Potassic Permanganate." This article was cited in *Industrial Education in the United States* (1882) as a rare scientific publication in chemistry by a woman.

Silliman chose to reprint an original article by Robert Hare on his famous oxyhydrogen blowpipe in the pages of *The American Chemist.* This followed his presentation at Northumberland on this subject. It is still worth reading (Vol. V, p372).

Henry Wurtz submitted two articles by Dr. David Alter (1807-1881) that had been published in *The American Journal of Science and Arts* in 1854 and 1855. They were quite important, but had received almost no recognition. The first article was "On Certain Physical Properties of Light, Produced by the Combustion of Different Metals, in the Electric Spark, Refracted by a Prism." He followed up Fraunhofer's work on the solar spectrum and created his own large refracting angle prism. The observed spectra from 12 different metals contained discrete lines. The second paper focused on the spectrum from gases exposed to the spark gap. Characteristic lines were observed for each gas. The age of atomic line spectra was inaugurated.

Volume VI

After the excitement of 1874, there was still plenty of chemistry to publish and the Chandlers solicited papers from Europe as well. The University of Michigan was founded in 1817 and has served the Midwest well for 200 years. Albert Benjamin Prescott (1832-1905) graduated in Medicine in 1864 and never left. He was Dean of the School of Pharmacy and Director of the Chemical Laboratory. Prescott served as President of the American Chemical Soceity in 1886 and of the AAAS in 1891. He submitted two papers for publication carried out by Masters students at Michigan.

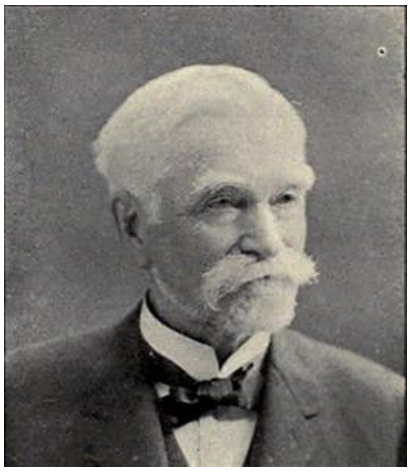

Figure 3.27 Albert Benjamin Prescott, Michigan's Best

A feature article by Alfred Nobel (1833-1896) on "Modern Blasting Agents" appeared in the August issue. He recounts a few attempts to synthesize agents that were both strong explosives and safe to use. Gun cotton (nitrocellulose) is still in use. Nobel discusses the many issues that should be solved in order to use a particular explosive product. Dynamite was commercialized in 1867. It is a mixture of nitroglycerine and porous silica.

Figure 3.28 Alfred Nobel, Dynamite Industrialist

The Chemistry Sub-Section of the American Association for the Advancement of Science was very active and held a meeting at Detroit, Michigan, in August, 1875. The President of the sub-section was S.W. Johnson and the Secretary was F.W. Clarke. Clarke delivered a plenary lecture on "Chemistry of Three Dimensions," which was printed in issue No. 3. (There was, as yet, no American Chemical Society, and there was considerable discussion about the need for such a separate organization.) Clarke made no mention of the work of van't Hoff on chemistry in three dimensions, but he did address serious questions about how to describe the actual geometric atomic structure of molecules. There were many vague notions and also outright fallacies still current in America. He also assumed that all chemical atoms were "the same size," and differed only in mass. He envisioned a day when the joint efforts of physicists and chemists would solve these problems. (Clarke held both professorships at the University of Cincinnati.) Brief summaries of all the chemical papers were printed in *The American Chemist* and full papers for some of the more important ones.

H. Carrington Bolton continued to publish papers of historical and bibliographic significance: "Notes on the Early Literature of Chemistry: VI." It discusses the recently discovered and acquired Egyptian papyrus that was from the 16th century B.C.. Bolton had access to a facsimile of this papyrus, entitled: *The Hermetic Book of Medicine of the Ancient Egyptians in Hieratic Writing.* It had

been obtained in Egypt by the archaeologist, George Ebers of Leipzig. This early Egyptian work has now been translated and authenticated.

Charles F. Chandler was greatly interested in the gas light industry and served on the Gas Board. He printed his address to the American Gas Light Association in the June, 1876 issue. Deliberate manufacture of combustible gas was begun in the 17th century, but it was not until the dawn of the 19th century that commercial use of illuminating gas was introduced by William Murdoch (1754-1839) of Cornwall. Gas lighting was introduced to New York in 1827. Bituminous coal is heated and the effluent gases are collected for distribution. But, first, the condensable substances must be removed and then the remaining impurities separated. Chandler made an analysis of the complex mixtures involved in this process. Actual industrial chemistry is both much more complicated and considerably more interesting than textbook reactions.

One of the longest articles to appear in the Journal in 1876 was "Geometric Chemistry" by Henry Wurtz of Hoboken, New Jersey. It is an example of the kind of chemical nonsense perpetrated by T. Sterry Hunt. Massive numbers of calculations are applied to the question of the relation between mass density and chemical structure, with little or no actual success. Nevertheless, the ten commandments of this new science are presented and submitted for acquiescence. Appeals to strict method and careful reasoning are made in the cause of obfuscating the failure of the approach to produce anything of value.

The American Chemist was chosen to report the first meeting for organization of The American Chemical Society in issue 11. Thirty-five people attended the meeting in New York. Charles F. Chandler was elected President and Isidor Walz was elected Secretary. Dr. Walz presented a detailed report of the progress towards forming a chemical society. A circular announcing the intention to form a society was printed in the report and sent to approximately 100 chemists in the greater New York area. The response was so encouraging that a further circular was sent to a national selection of chemists, and 60 people responded positively. The advisability of actually forming the society was discussed. Even H. Carrington Bolton was leery of diluting the existing efforts of groups like the Chemical Section of the AAAS. After the formal vote, the Constitution and By-

laws were presented to the group and published in the *American Chemist.* The group met again on April 20th to formally elect officers and to arrange for further meetings on the third Monday of every month. John W. Draper was elected President and many Vice-Presidents were chosen. Isidor Walz continued as Secretary throughout this process. Thus was the American Chemical Society formed and launched in *The American Chemist.*

The American Chemist was also the publication of record for the New York Academy of Sciences, Chemical Section. An interesting paper on "The Manufacture of Japanese Paper" was presented by Henry S. Monroe of Columbia College, including a real sample bound in the printed volume! H. Carrington Bolton read one of his "Notes on the Early Literature of Chemistry at this meeting and it is reproduced here as well. It concerns a 12th century Arabic treatise, *The Book of the Balance of Wisdom,* obtained and translated by Chevalier N. Khanikoff, the Russian Consul General in Tabriz. The author was identified as al-Khazini, which was claimed to be the famous Alhazen, the Arab optician and physiologist. J.W. Draper greatly admired the work of Alhazen. The work discusses the use of precision balances. An account of using the specific gravity of gold-silver alloys to determine the composition was given. Bolton detects that the account is a bad retelling of an older tradition in Latin. Nevertheless, a good presentation of the instruments for measuring specific gravity is given and Bolton's article is worth reading today.

Issue No. 12 contains the Proceedings of the May 4th meeting of the American Chemical Society. At the June 1st meeting, many people were proposed for membership. Published versions of the talks were also printed.

Things were moving very rapidly for both the Chandlers and for the American Chemical Society. *The American Chemist* contains the details of these events.

Volume VII

The American Chemist sought to remain current with regard to its treatment of industrial chemistry. One of the raging subjects in this time period was the use of the new color: aniline black. An extensive discussion of a patent infringement suit was presented by S. Dana Hayes, who had been an expert witness in the case. There were also a series of articles republished from foreign sources, like *The Textile Colorist,* on the subject of aniline black, produced by metals other than copper, especially vanadium. Interest in dyes and colorants has not diminished in the present.

A regular report of the Proceedings of the American Chemical Society characterizes Volume VII. Many new members are announced. In issue No. 3, the Proceedings for September 7 are presented. This issue also includes two outstanding lectures from England. The first is the Bakerian Lecture "On the Gaseous State of Matter" by Thomas Andrews, FRS (1813-1885) of Queen's University, Belfast. The equation of state data for carbon dioxide reveals the nature of real gases over their entire gaseous range. The molecules display both attractive and repulsive interactions. Andrews was noted for his work on the liquefaction of gases and his investigations of the gas-liquid critical point. The second plenary lecture was abstracted from the President's Address at the Glasgow meeting of the British Association for the Advancement of Science on September, 6, 1876. Sir William Henry Perkin, FRS (1838-1907) presented a detailed history of the discovery and application of coal tar based dyes, such as alizarin. Perkin remained very popular in America and was lavishly feted during his visit to the United States in 1906, where he received the first Perkin Medal from the American Section of the Society of the Chemical Industry.

Issue 4 reported the Proceedings of the American Chemical Society meeting on October 5, 1876. Plans were announced for the inaugural address by John Draper on November 16, 1876. A slate of famous honorary members, including Marcellin Berthelot, Robert Bunsen, A. von Butlerov, Stanislaus Cannizaro, Edward Frankland, A.W. Williamson and Friedrich Wohler, were nominated.

One interesting article is entitled "Laboratory Notes" by T.A. Edison (1847-1931). It is easy to forget that Edison was also a chemist. His article discusses many systems involving the mixing of solids and liquids. My favorite Edison chemical story involves the carbon microphone. Edison understood electrochemistry and discovered that graphite was a conductor. The detailed properties of natural graphite deposits were quite variable. He sold his invention to AT&T. They were unable to reproduce Edison's demonstrated results. For an additional fee Edison sold them the information of where to mine the graphite!

The American Chemist was also the journal of record for the American Association for the Advancement of Science. Issue No. 5 contained the details of the Buffalo, New York meeting on August 25, 1876. The President's Address for the Chemical Section by George F. Barker, discussed in Chapter 2, is printed here.

Issue No. 6 reports the November 2 American Chemical Society Meeting and also prints the Inaugural Address from John W. Draper presented on November 16 in Chickering Hall. This address was discussed in Chapter 2. The printed version includes an especially fine ink and pen portrait of Draper. (Fig. 3.29)

Figure 3.29 Dr. John W. Draper (from Volume VII)

The December Meeting of the ACS occurred on December 7. The January 4, 1877 meeting got the New Year off to a good start. One of the innovations for 1877 was the initiation of informal *Conversazione*. The local members gathered to share both technical and personal information. The final issue of *The American Chemist* (No. 10) appeared in April 1877.

The final publication from the Chandlers was a separate printing of the Centennial of Chemistry. It is bound with Volume VII in my copy.

Concluding Reflections

The activities and thoughts of the American chemical community in the 1870s are detailed in the volumes of *The American Chemist.* The sheer volume of material contained in these seven volumes may surprise chemists in the 21st century. While the focus of many of the articles was on industrial and analytical chemistry, there were also key treatments of theoretical and physical chemistry.

The primary value of these volumes is the documentation of hundreds of American chemists in this decade. It was indeed the "right time" to form a national chemical society.