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A Selection of Highlights from the History of the National Academy of Sciences, 1863–2005

Frederick Seitz
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FOUNDING

The Academy’s charter was introduced to Congress by the well-established Senator Henry Wilson from Massachusetts. It was passed by Congress and signed by President Lincoln in March of 1863, near the end of the second year following the start of the Civil War in April of 1861. The charter requested the members to serve the government on scientific and related technical problems without personal remuneration apart from out-of-pocket expenses such as cost of travel, housing accommodations and the like. It had no truly official home at the time, and in that sense was essentially a paper organization.

ALEXANDER DALLAS BACHE

The Academy started with fifty charter members under the presidency of Alexander Dallas Bache (1806–1867). The number was not increased during the remaining years of the war because a generally acceptable means for electing them had not yet been developed. Bache was a great-grandson of Benjamin Franklin, an outstanding West Point trained physical scientist and engineer as well as an expert in numerous other fields. He had been born and raised in Philadelphia and always looked on that community as his home base.

An individual of quiet demeanor, Bache was a very serious student at West Point and graduated first in his class. He was greatly admired by a group of colleagues who took the time and effort to shield him from occasional sportive distractions in which they might engage. On graduation in 1825, he continued at West Point as an assistant professor for a year. This was followed...
by two years of engineering duty in Rhode Island, which was followed in turn by an appointment to the chair of physics and chemistry at the University of Pennsylvania. He also accepted a position at the newly created Franklin Institute, which gave him an opportunity to investigate important technical problems, such as the frequent explosion of steam boilers. In addition, he became interested in fluctuations in the earth’s magnetic field and made measurements of it. He also studied the relative thermal effects of various parts of the visible and invisible portions of the optical spectrum derived from the sun.

In 1836 the trustees of the newly created Girard College for Orphans in Philadelphia offered him the position of president, which he accepted reluctantly out of a sense of duty to public service. The offer carried with it a fund that permitted him to make a two-year study of educational practices in Europe, where he was well received everywhere he traveled, partly in memory of his widely famed great-grandfather. On returning he found that the post at Girard College was not yet available because of delays in building construction. As a result he offered to make a study of educational practices in the public school system of Philadelphia, serving as head of the Central High School of Philadelphia. His offer was accepted and led to a substantial modification of the ongoing system in keeping with his European experience. In the meantime, matters continued to lag at Girard College, but the University of Pennsylvania gladly welcomed his return in 1842. He was soon extending research programs he had left behind.

A year or so later he was offered the newly vacant position of Superintendent of the United States Coastal Survey, which he accepted with his usual
trepidation when considering a major change. Actually he found his life’s mission in the new post and was very successful. He received many auxiliary appointments, some honorific, others in the line of duty. His relations with Congress were excellent although he was occasionally asked: “When will you finish the survey?” His invariable response was: “When you cease annexing territory!”

To accomplish the tasks of the Survey, Bache needed a very competent staff and was fortunate in acquiring some extraordinarily capable individuals. He found one, George Davidson, while working with the Philadelphia educational system. Davidson was the leading student in his high school class and proved to be a very helpful aide in connection with Bache’s experiments. He joined the Survey on graduation and, as we shall see later, soon rose to one of the leading positions on the staff.

In his will, Alexander Bache left the sum of $40,000 in trust to the Academy with the understanding that the income would be available to his widow for the remainder of her life and could then be used for the needs of the Academy. This first significant bequest played an important role during the start-up peacetime period that followed. By 1895 the accumulation of such trust funds came to $87,000.

**The Smithsonian: Joseph Henry**

At the time the National Academy of Sciences was formed, the most distinguished scientist in the country was Joseph Henry, the first director (Secretary) of the Smithsonian Institution in Washington, D.C.—a position to which he had been appointed in 1846. This followed a series of Congressional debates that lasted some ten years following the arrival in Washington in 1836, in the form of gold bullion, the very significant bequest by an Englishman, James Smithson, the illegitimate son of the Duke of Northumberland, that funded the start of the Smithsonian. Smithson’s intent was to try to help the young democratic country become as deeply involved in scientific research as possible. When minted into American gold coinage the total bequest from Smithson totaled about $650,000—a very large fortune for those days.

Henry was made a founding member of the Academy, but had not been informed of the detailed plans of the founding committee along the way, presumably either for fear that he would dominate decisions regarding details, or might disapprove of the creation of an academy during wartime. Actually, Henry expressed concern regarding the fact that the newly formed Academy had roots in governmental action, since he feared that it might thereby become politicized. He had reason for his fears since, at the Smithsonian, he had to deal with the membership of a regency that oversaw his activities and was
appointed by Congress. The Chief Justice of the United States serves *ex officio* as a member of the regents and by tradition as chairman (Chancellor). The Vice President also serves *ex officio*. The membership includes three senators, three representatives from the House and six from the more general public. The latter may include heads of museums, distinguished academics, and other members at large, such as lawyers and businessmen. Service on the board of regents is regarded as a special honor, particularly among individuals close to the District of Columbia. Actually Henry was not only a skilled politician, but he quickly won the deepest respect of the Washington community and had little difficulty personally dealing with the regents. Finally he did agree to be a member of the newly formed academy in spite of the misgivings mentioned above.

Henry (1797–1878) was born in Albany, New York. While growing up he spent time both there and with relatives in the nearby smaller town of Galway, which has commemorated this fact by naming a very handsome elementary school building after him. His advanced education was obtained at the Albany Academy, which continues to be an active institution and which had a year-long celebration of the bicentennial of Henry’s birth in 1997. There he developed two great interests: science, particularly physics, and acting on a live stage. He was torn in making a selection between the two when he finally had to decide on a career, but swung to physics when he had an opportunity to experiment with large electromagnets of his own making at the Albany Academy. Incidental to this, he discovered the magnetic induction of electric currents in electric conductors in 1831, a year before Faraday who
published the discovery first. Both individuals, however, are fully credited with independent discovery of this phenomenon. The official name assigned to the physical unit of electromagnetic inductance is The Henry. Henry's ability as an actor may have stood him in good stead during the Washington years that were to come.

Henry remained at the Albany Academy until 1832, when he accepted a professorial appointment at what is now Princeton University. There he remained actively creative, particularly in connection with the development of the electromagnetic telegraph, until he was called to Washington to head the Smithsonian.

During the Civil War, Henry spent as much time as possible studying the properties of electrically operated devices that could be used for communication, often working at night in one of the towers of a building of the Institution when he was apt to be relatively free of other obligations. A private citizen noted the flashing lights one evening and rushed into the White House to inform President Lincoln that a spy was using the Institution to signal across the Potomac. The President formed a small detachment of soldiers and rushed to the tower, only to find, and meet for the first time, the great scientist busy doing what he enjoyed most. They became good friends. It is said that Lincoln once made the comment that he believed that Henry was the most intelligent individual he had ever met.

The members of the Academy investigated the problems that came to them during the war as best they could, although nothing truly outstanding in the way of innovation occurred as a result of their activity. This was a period in which most innovation centered about the activities of ingenious inventors who focused on mechanical and early electrical systems, such as steam-powered, iron-plated warships, rifled guns and improvements in the telegraph system.

When the Civil War ended in 1865, the members of the National Academy were faced with the problem of determining how it might be used in peacetime. They had models in Europe that could be employed as a guide. However, the latter had not only been established for a relatively long time but along the way had been endowed, usually by royalty and "philosophers of wealth", with significant resources such as money for running expenses and buildings where meetings could be held and records stored. In real terms, the National Academy of Sciences only possessed a charter and the interest of its founding members.

In the meantime Bache had resigned as president at the end of the war because of rapidly failing health, leaving his office in the hands of the vice president. The latter was also in bad health and in turn gave his office over to Joseph Henry. The most obvious solution was to offer the position of president to Henry who had the capacity to serve in an imaginative manner and
provide something in the way of a significant foster home at the Smithsonian. He refused. It was not only that he was approaching his seventieth year, but also continued to enjoy carrying on research, particularly in connection with acoustics. Still further, he had not been greatly enamored of the surreptitious manner in which the Academy had been formed along with its links to the federal government.

JOSEPH HENRY

Finally, when all else failed, the founders unanimously elected Henry, who had been serving as acting president, to the position of president in 1868 and abandoned further search. Placed in this position, Henry must have thought deeply about the situation, granting that he had done his best to avoid it. It must have been clear to him that a long time might pass before another opportunity would arise in which the scientific community would be able to develop a viable National Academy of Sciences if the existing one were allowed to lapse. Finally, he decided to move ahead and accepted the position. He held it from 1868 until his death in 1878. The academy remained somewhat of a foster child of the Smithsonian until it entered what was truly to be its own headquarters on Constitution Avenue in 1924. Until then, most of the meetings were held at the Smithsonian.

Once in office, Henry moved with alacrity to straighten affairs. The annual election of members was to be determined by a set schedule and based primarily on the quality of the candidate’s original scientific research as determined by peers who were already members. Individual members were to belong to one of a group of ten sections as determined by their primary professional interest. A pattern of officers and regular meetings was formalized. By the time Henry left office, the Academy was pointed in the direction it would try to maintain thereafter, and for the most part has. There would be major additions to the areas of science that were given official recognition as “mature”, with flexible guides governing the number of members elected each year in each professional field. This flexibility was required as the country emerged as one of the leaders in scientific research in the world and the size and complexity of its scientific community increased. Also, the Academy’s structure would become more complex as it added organizations it created for special purposes, such as the National Research Council (NRC) in 1916, the National Academy of Engineering (NAE) in 1965 and the Institute of Medicine (IOM) in 1970.

Many of the activities of the Academy tended to be available to an exclusive few. However the popular interest in the products of science was large in
the Washington area. To bridge this gap, Henry decided to create The Washington Philosophical Society in which the results of scientific research could be discussed before a large popular audience. Membership in the Society was relatively open to any individual who had appropriate credentials and interest. The Society still exists today.

President Grant declared 1876 a year in which to celebrate the centennial of the signing of the Declaration of Independence. The Academy joined in the festivities, but did not invite any foreign academies to send formal representatives. Henry decided that the American contribution to the exact sciences was so meager at the time that it would be unwise to display our limitations. Nevertheless many members of foreign academies did attend the celebratory meetings partly to pay respect to the burgeoning nation, and partly to see how people lived in a republic. Some visitors who had been reared on Western and Midwestern lore about the country were impressed with the extent of the wild forestlands.

We do not know if the news had reached Henry by the nation’s centennial year, however, that in 1875 a twenty-seven year old American, Henry Rowland (1848–1901), working very skillfully with facilities provided in the laboratories of Hermann Helmholtz in Berlin, was able to verify experimentally Maxwell’s hypothesis that a varying electric field generates a magnetic field, the counterpart of magnetic induction mentioned earlier but a far more difficult matter to demonstrate. Alongside of this was the emergence of theoretical research at the world-class level by Josiah Willard Gibbs (1839–1903) in fields such as thermodynamics and statistical mechanics. The spirit needed for the cultivation of the exact sciences was alive and well in the new world and merely needed encouragement.

The transcontinental railroad began service soon after the end of the war (1869), opening the continent to relatively convenient travel. The first serious discussions regarding the possibility of cutting some form of canal through the Isthmus of Panama took place at this time. However fifty years and Herculean efforts that involved employing the best mechanical equipment and health-preserving knowledge available at the later time would be required to achieve the goal.

Events at the Academy turned out to be complex and even somewhat tempestuous at times during Henry’s tenure as president. Some members who were based far from Washington felt that the content of the meetings was too meager to merit the time and expense of travel and either resigned or ignored the responsibilities of membership. Others objected to some of the individuals chosen and voiced complaints. Then there were ill-conceived attempts to form competing science academies that had to be forestalled in Congress. Henry struggled through these difficulties with well-defined purpose. Dealing
with them was sufficiently taxing that the regents decided to provide the financial means that made it possible for Henry to spend a six month break in Europe where he visited laboratories, institutions and other places, particularly in England, and discussed the early stages of the development of the Smithsonian. He was given appropriate recognition as a great scientist.

There was also fear that larger sections of the Academy would come to dominate the election procedures through strength of numbers and squeeze out the smaller ones. As a result, a decision was made in 1870 to abandon the division into sections. They were, however restored in 1895. Actually, the basic difficulties were not adequately resolved until the following century when sections were assigned individual quotas that could be varied occasionally and new entities that focused on engineering and the medical professions were created.

Many members did report on their personal research at the meetings. At the time this tended to emphasize the less abstract areas of science, that is, the so-called natural sciences, particularly descriptive biology. There was little mathematics, physics or basic chemistry.

As an institution, the Academy became involved in two programs of general interest. One of the peripheral concerns dealt with an ill-fated scientific expedition to the Arctic by sea in which the ship became entrapped in ice and destroyed. The other involved an advisory role in the consolidation of several organizations that had undertaken geological and geographic surveys of the continent. As will be mentioned later, the latter led to the creation of what is now the U.S. Geological Survey within the Department of Interior (1879).

Henry’s fears concerning possible dire consequences that might result from the Academy’s links with the federal government have not yet been realized by it. Occasionally someone on the Hill has been sharply critical of a report issued by the Academy, or some stated matter regarding policy. On the whole, however, the government has not only been respectful of its work, but has frequently called upon it heavily for advice. This was particularly the case in the decades immediately following World War II, when our country was evolving new structures for supporting scientific research. At worst the Academy has been ignored at times when some of the members thought it might have been of substantial help in determining national policy on issues, ethical and otherwise, that had substantial scientific content.

Nevertheless, there is currently a strong feeling within the membership that the Academy should gain more independence from the government in providing support for special areas of research, such as those on which the use of government funds is restricted because of ethical issues. The membership now hopes to achieve this goal by increasing its endowment by a substantial amount. Henry would have approved, provided the fundamental principles
upon which the scientific method is based, namely a careful combination of speculation and observation along with a level playing field devoid of political bias, are preserved in professional deliberations.

The Smithsonian Institution has not fared so well recently. During most of the years following Henry’s death, the regents of the Institution turned to the Academy for advice in selecting a new Secretary. As a result, the Institution enjoyed the services of an unbroken chain of Secretaries who were distinguished scientists and members of the Academy. This pattern broke down when one individual who held the office, an outstanding scientist in his own field of research and a member of the Academy, produced an exhibit that caused some bitter controversy. The successor selected by the Regents, a lawyer, was not a member of the Academy. The subsequent Secretary was previously a banker. There is evidence that the breach may heal to a degree but it is too early to say what pattern will prevail in the future. In any event, and in keeping with Smithson’s wishes, one would hope that the Regents will again select a well-recognized scientist with good administrative ability as Secretary.

It may be added that Henry had earned so much admiration as a result of his activities in Washington that the procession and ceremonies that developed at the time of his funeral are said to have matched those of some of the prominent generals of the Civil War.

WILLIAM BARTON ROGERS

Immediately following Henry’s death, the vice president, Othniel Charles Marsh (1831–1899) a paleontologist, who possessed a professorship at Yale, assumed the office of president while elections for a new president took place. The individual finally chosen was William Barton Rogers (1804–1882), the president and founder of the Massachusetts Institute of Technology (MIT). His education was in physics and chemistry but he became an expert geologist as a result of his extensive interest in applying those disciplines to the problems of geology, including the relationship between agriculture and the constitution of soils.

Rogers was born and raised in Williamsburg, Virginia, where his father, an Irish immigrant, was professor of physics and chemistry in William and Mary College. He received his education there and was given his father’s chair at the age of twenty-four on the latter’s death. He became a celebrated lecturer while engaged in research. Initially, he focused on fundamental problems in physics such as the formation of dew and the behavior of currents derived from voltaic cells, but he soon became involved in geological problems, for which he gained fame.
In 1835, he accepted a professorial position at the University of Virginia and at the same time was officially appointed state geologist with access to funds that would permit a state-wide geological survey. In the new post, and while maintaining a normal teaching schedule, he and his brother Henry, who was state geologist of Pennsylvania, joined forces in detailed studies of the Appalachian region that were carried out between 1835 and 1842. Their survey was both detailed and wide-ranging. For example, they marked the nature of soils, the location of hot springs and studied the solvent action of water on individual geological formations and its effects on plant growth in neighboring areas.

On the tectonic side, they devoted much attention to the rows of folded mountain chains that characterize substantial portions of the Appalachians and must have wondered about the nature of the underlying forces that brought about the folding. They studied detailed consequences of folding on individual ranges and wrote reports that drew worldwide attention. The brothers followed up their survey with many papers derived from details of the information they had gathered.

Rogers had a long-standing interest in technical education. As a southerner possessing a professorship at the University of Virginia he had well-developed plans to establish an institute of technology in the state. Unfortunately many of the students in the Southern academic institutions were in a violent mood, being much less focused on education than on the politics associated with possible withdrawal of the Southern States from the Union. Roger’s wife, who was from New England, urged him to consider placing the institute in Boston where the climate for it would be much more favorable. Rogers, who was of a genial,
peaceful nature, heeded her advice when a militant student “of excitable nature” shot one of Roger’s close Virginia friends who opposed separation from the Union. The new institute received a state charter in Massachusetts in 1861. On the somewhat amusing side, Rogers recommended that the institute remain permanently in Boston, and avoid any suggestion of moving to Cambridge. At that time, Harvard students had the reputation of being unruly, and he was not anxious to see that characteristic develop at his technical school.

Unfortunately, Rogers, who was in his mid-seventies when he took office at the Academy, suffered from ill health during the period and it became necessary for Marsh to take over his responsibilities on several occasions. Fortunately, the unrest within the ranks of the membership with which Henry had to deal had settled down to a considerable extent so affairs within the Academy moved ahead more smoothly.

Perhaps the major outside development affecting the Academy at the time was its involvement in matters of public health. A deadly epidemic of either yellow fever or cholera broke out in Louisiana in 1878 and rapidly spread up the Mississippi River, making it clear that some form of action at the national level was needed in the event of serious epidemics. The immediate reaction of Congress was to create a National Board of Health and call upon the Academy to serve as an advisory body. Activities lapsed after the epidemic waned and the Board was eventually replaced by the Public Health Service, which evolved out of the Marine Health Service.

Rogers died suddenly in 1882 while distributing diplomas at commencement in Boston. While his scientific work was very distinguished, one of his important contributions as president of the Academy was, as mentioned above, the ability to promote peace and calm in the organization mainly through force of his genial personality.

John Wesley Powell

The period immediately after the Civil War saw extensive exploration and surveying of the lands west of the Mississippi River by a number of essentially independent groups, usually having relatively independent goals. The one that drew special public attention, in its way comparable to that received by the Lewis and Clark expedition to the West Coast (1804–1806), was John Wesley Powell’s exploration of the Colorado River, carried on as a part of the study of the Rocky Mountain Area and its extensions (1871–1879). The situation called for an essential amount of unification of such exploration in order to provide coherence and continuity. The result, led to a considerable extent by Powell, was the creation of the U.S. Geological Survey, which will be discussed below.