Humphry Davy

His Life, Works, and Contribution to Anesthesiology

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HISTORY offers us a tool to avoid the condemnation George Santayana (1863–1952) envisioned for those who forget the past.[1] In studying the history of anesthesia, and in particular the singular events that brought anesthesia into the consciousness of the world in Boston in 1845 and 1846, we find much to admire, but even more that we might hope not to repeat.

The first public demonstrations of anesthesia, by Horace Wells (1815–1848) in 1845 and William T. G. Morton (1819–1868) in 1846, initially capture the imagination with their daring audacity. We can picture Wells' shame and astonishment as his patient cried out during the ill-fated tooth extraction under nitrous oxide anesthesia, much as we can hear John Collins Warren (1778–1856, professor of anatomy and surgery and first dean of Harvard Medical School), proclaiming less than 2 yr later: "Gentlemen, this is no humbug" after Morton's more successful demonstration of ether anesthesia.[2] But these promising beginnings yield unhappy sequels, and our enthusiasm wanes as we learn of Morton's penchant for fraud, embezzlement, and self-promotion and Wells' imprisonment and eventual suicide in the Tombs penitentiary.[3]

Implicit in our disappointment is a desire, perhaps, to find among the founders of our profession a model figure, a person whose efforts foresaw anesthesia not only as a spectacular discovery and potential source of profit but also as a science founded on pharmacologic and physiologic inquiry. We are looking, in short, for Humphry Davy. Some readers may be familiar with Davy's work and will recognize his life as a natural topic for discussion of the history of anesthesia. Others may harbor vague and generally unpleasant recollections of Davy in association with an undergraduate chemistry course. But few would identify Davy as a founder of the science of anesthesiology.

The goal of this article is, however, nothing less than to demonstrate that the title of first anesthesiologist belongs not to the likes of Morton or Wells but to Humphry Davy. In recounting the events of Davy's life, we will chart the spectacular ascendancy of a man who rose from humble origins in provincial England to become the foremost scientist in Europe or indeed the world at the time; a man who despite being almost entirely self-educated, would contribute six elements to the periodic table and whose inventions would revolutionize coal mining, agriculture, and art conservation; who would participate in the romantic literary movement; whose public lectures would draw ecstatic crowds of thousands; who would rise through the ranks of the British nobility; who would cross the blockaded English channel at the very height of the Napoleonic wars to consult with colleagues on the European continent; a man of rare and prodigious genius: Humphry Davy.

Davy's Early Years and Education

Davy was born December 17, 1778 in Penzance, a small town in southwest Cornwall; he was the eldest of five children.[4] The son of an itinerantly employed woodcarver, Davy attended local grammar schools until the age of 15 yr, when his father died unexpectedly, leaving the family encumbered with debt and compelling Davy to return home. Little is known of Davy's school years, but he certainly gave little indication of his future potential to his headmaster, Dr. Cornelius Cardew (1748–1831), who said of Davy: "He was not long with me; and while he remained I could not discern the faculties, by which he was afterwards so much distinguished."[5] Leaving school, the 15-yr-old Davy was apprenticed to John Borlase (1764–1840), a Penzance surgeon-apothecary.[5] At this point Davy's prospects in life would have been hopeful but quite circumscribed. Bound by his apprenticeship, Davy could perhaps have anticipated a productive career as a provincial surgeon but would have had little hope of extending his horizons beyond his native west Cornwall.

Davy for his part was not prepared to accept this state of affairs. He instead determined that he would attend the famous medical college at Edinburgh, and he devised an ambitious, even heroic plan of independent study to achieve his goal.[4] In reviewing the plan (table 1), outlined in Davy's

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Table 1. The Young Davy's Plan of Study[4] in 1794 at Age 15 yr

Theology	Religion (Taught by Nature)
	Ethics (Taught by Revelation)
Geography	
My Profession	Botany
	Pharmacy
	Nosology
	Anatomy
	Surgery
	Chemistry
Logic	
Language	English
	French
	Latin
	Greek
	Italian
	Spanish
	Hebrew
Physics	Doctrines and properties of natural bodies
	Operations of nature
	Doctrines of fluids
	Properties of organized matter
	Simple astronomy
Mechanics	
Rhetoric and Oratory	
History and Chronology	
Mathematics	

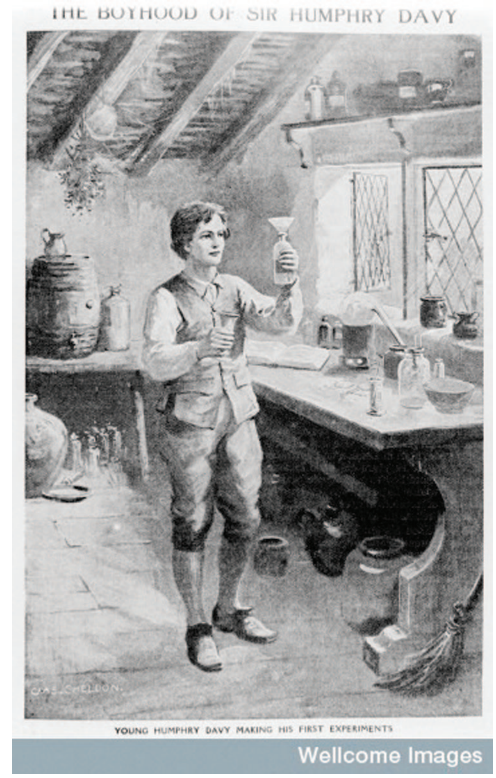

Fig. 1. Young Humphry Davy making his first experiments. Image courtesy of the Wellcome Image Library, London, England.

notebooks, with its list of seven languages, it is possible to discern an early indication that Davy was not an ordinary 15 yr old (fig. 1).

In 1797 his studies were greatly advanced by a fortuitous encounter with a copy of Antoine-Laurent Lavoisier's (1743–1794) seminal text *Traite elementaire de Chimie*. Not content to receive the wisdom of the great French chemist, Davy immediately set out to challenge Lavoisier and devised an experiment to overthrow Lavoisier's caloric theory of heat, declaring "caloric does not exist"; Davy's new dynamic theory of heat would prove foundational in the subsequent development of thermodynamics.[6] Davy's work gained the notice of one of the most renowned physicians in England at the time, the Oxford lecturer Thomas Beddoes (1760–1808). Beddoes was in a state of open revolt against medical orthodoxy, which was then still firmly rooted in Greek classicism and the elemental theories of Galen. In reaction, Beddoes turned to the new field of "pneumatic medicine," inaugurated by the recent discovery of oxygen by Joseph Priestly (1733–1804) and Carl Scheele (1742–1786). Beddoes held that the combination of nitrogen and oxygen found in atmospheric air was perfectly suited to the healthy individual, but he hoped that manipulation of these constituents might prove useful in the treatment of disease and, in particular, tuberculosis.[7] Beddoes had in mind to establish a new institute founded on the principles of pneumatic medicine, and he was in need of someone to conduct the institute's researches. Davy, Beddoes decided, would be that person. He traveled to Cornwall, met with Davy, and persuaded him to leave his apprenticeship and assume leadership of the nascent Bristol Pneumatic Institute.[5] Davy, not having completed so much as a secondary school education, was 19 yr old. On March 21, 1799, an announcement appeared in the *Bristol Gazette and Public Advertiser* recruiting patients for the new Bristol Pneumatic Institute. It read:

New Medical Institution. It is intended among other purposes for treating disease, hitherto incurable, upon a new plan. Attendance of persons in Consumption, Asthma, Palsy, Dropsy, obstinate Venereal complaints, Scrofula or King's Evil, and other diseases, which ordinary means have failed to remove, is desired. It is confidently expected that a considerable portion of such cases will be permanently cured. It has been perfectly ascertained by experience, that none of the Methods to be pursued are hazardous or painful. Attendance will be given from 11 till 1 o'clock by Thomas Beddoes or Humphry Davy.[8]

The Pneumatic Institute

In the 18th century, long before the advent of the Institutional Review Board, whether or not the institute's methods might be hazardous or painful had not in fact been determined, and Davy realized that as a preliminary step he would need to establish which gases could be inspired without causing serious injury. To perform these experiments, he enrolled the most readily available and susceptible healthy volunteer he could find: himself. Hence arose Davy's first written account of an episode of laryngospasm, precipitated by his attempt to breathe pure carbon dioxide. His description, although anatomically imperfect, nevertheless captures the power of this reflex and also reminds us of its protective mechanism. Davy writes:

I introduced into a silk bag four quarts of carbonic acid produced from bicarbonate of ammonia by heat, and after compleat voluntary exhalation of my lungs, attempted to inspire it. It tasted strongly acid in the mouth and fauces, and produced a sense of burning at the top of the uvula, In vain I made powerful voluntary efforts to draw it into the windpipe; at the moment that the epiglottis was raised a little, a painful stimulation was induced, so as to close it spasmodically on the glottis; and thus in repeated trials I was prevented from taking a single particle of carbonic acid into my lungs.[9]

Undeterred, Davy set out to breathe carbon dioxide again as a 60% solution in air but again developed laryngospasm, before settling on a 30% solution in air, from which we have the first description of carbon dioxide narcosis:

I breathed it for near a minute. At the time it produced a slight degree of giddiness and an inclination to sleep.[9]

We are similarly indebted to Davy for the first account of carbon monoxide poisoning, described as follows:

After the second inspiration, I lost all power of perceiving external things, and had no distinct sensation except a terrible oppression of the chest. During the third expiration, this feeling disappeared, I seemed to be sinking into annihilation and had just power enough to drop the mouth-piece from my unclosed lips … on recollecting myself, I faintly articulated "I do not think I shall die." Putting my finger on my wrist, I found my pulse thread-like and beating with excessive quickness … after making a few steps which carried me to the garden, I had just sufficient voluntary power to throw myself on the grass.[9]

Davy found that his chest discomfort slowly resolved over the next 5 min, but returned 45 min later after he attempted to go for a walk:

The giddiness returned with such violence as to oblige me to lie on the bed; it was accompanied by nausea, loss of memory, and deficient sensation. In about an hour and a half, the giddiness went off, and was succeeded by an excruciating pain in the forehead and between the eyes, with transient pains in the chest and extremities.[9]

Davy noted that hydrogen was equally unpleasant to breathe, albeit without so much lingering discomfort:

I perceived a disagreeable oppression of the chest, which obliged me to respire very quickly; this oppression gradually increased, till at last the pain of suffocation compelled me to leave off breathing … a bystander informed me that towards the last, my cheeks became purple.[9]

Davy kept careful records of his inspired and expired gas concentrations during these experiments, so we know that at the conclusion of his trial of hydrogen, the partial pressure of oxygen in his alveoli was no higher than 20 mmHg, indicating a hemoglobin saturation of roughly 50%.

Table 2. Humphry Davy's Lung Volume Measurements

	Davy's Measured Lung Volumes (ml)	Predicted Lung Volumes for Davy (ml)
Total lung capacity	4,704	4,760
Vital capacity	3,491	3,510
Tidal volume	278	270
Functional residual capacity	1,934	2,675
Residual volume	1,213	1,250

Davy's measurements and comparative estimates of Davy's predicted lung volumes are shown. To predict Davy's lung volumes requires some guesswork in that we do not know his height or weight. In Researches Davy notes that his chest circumference is a rather diminutive 29 in. Predicted lung volumes shown here assume a height of 66 in (1.67 m) and a weight of 54 kg and are drawn from measurements of lung volumes conducted by Hutchison[20] and the reference values of the European Respiratory Society.[21]

Davy had not been solely impressed by the ability of hydrogen to provoke chest pain; he also noted that when he breathed the gas in a closed system designed around a mercurial air holder, none of the gas was measurably absorbed through the lungs. Davy observed with great interest the absorption of oxygen and evolution of carbon dioxide during the course of respiration, and he hoped to make detailed measurements of the solubility and uptake of various gases but was frustrated by his inability to quantify his own lung volumes accurately. Davy was the first to discern the existence of a residual volume remaining in the lung at the end of forced exhalation and saw in hydrogen the solution to his problem: by recording the dilution of insoluble hydrogen in his lungs he would now be able to measure residual volume. Davy also made careful measurements of his tidal volumes and vital capacity and calculated his oxygen consumption and the respiratory quotient with surprising accuracy (table 2).[9–11]

Not all of Davy's experiments were so morbid and nearly mortal as those involving carbon monoxide. Among the various gases Davy worked with at Bristol, one in particular stands out for the favorable impression it made on the young scientist. In 1779, Joseph Priestly had described the production of a colorless gas formed by heating nitrous acid in the presence of zinc. Upon exposing mice to the gas Priestly found that they quickly died, and therefore he abandoned further experiment, calling his discovery "dephlostigated nitrous air," a reflection of the phlostigon theory then current in chemistry.[12] Davy's interest in Priestly's dephlostigated nitrous air began while he was still in Penzance. At the time he read an article by the American congressman and erstwhile scientist Samuel Latham Mitchell (1764–1831) that sought to condemn the gas as "the principle of contagion," that is, the underlying cause of all infectious disease.[13] Davy, perhaps inherently distrustful of politicians, sensed that Mitchell's theory was incorrect and devised a few rudimentary experiments to disprove the alleged contagious properties of the gas, but was unable to produce the gas in sufficient quantities and purity to make a definitive claim. In Bristol, Davy again took up dephlostigated nitrous air, happily bequeathing it a new and less cumbersome title: nitrous oxide. Drawing on the method of French chemist Claude Berthollet (1748–1822), Davy first devised a new synthesis involving thermal decomposition of ammonium nitrate and found that he could now produce great quantities of nitrous oxide with a high degree of purity. Next, he exposed a variety of small animals to pure nitrous oxide; he found that, although his subjects could tolerate brief exposure nitrous oxide, longer exposures, on the order of 15 min, resulted in death or grave disability, with "most of the animals that … recovered after breathing nitrous oxide [being] convulsed on one side, and paralytic on the other."[9] To Davy, the next step was clear: he would administer pure nitrous oxide to himself:

The moment after I began to respire 20 quarts of unmingled nitrous oxide. A thrilling extending from the chest to the extremities was almost immediately produced. I felt a sense of tangible extension highly pleasureable in every limb; my visible impressions were dazzling and apparently magnified, I heard distinctly every sound in the room and was perfectly aware of my situation. By degrees as the pleasureable sensations increased, I lost all connection with external things; trains of vivid visible images rapidly passed through my mind and were connected with words in such a manner, as to produce perceptions perfectly novel. I existed in a world of newly connected and newly modified ideas. I theorized; I imagined I made new discoveries. When I was awakened from this semidelirious trance by Dr. Kinglake, who took the bag from my mouth, indignation and pride were the first feelings produced by the sight of persons about me. My emotions were enthusiastic and sublime; and for a minute I walked around the room perfectly regardless of what was said to me. As I recovered my former state of mind, I felt an inclination to communicate the discoveries I had made during the experiment. I endeavored to recall the ideas; they were feeble and indistinct; one collection of terms, however, presented itself, and with the most intense belief and prophetic manner I exclaimed to Dr. Kinglake, "nothing exists but thoughts! — the universe is composed of impressions, ideas, pleasures and pains!"[9]

Davy by no means felt that this euphoric experience of nitrous oxide should be an isolated occurrence, and on the contrary he magnanimously shared his supply of the gas with his friends, his acquaintances, his patients, with curious visitors, but above all, as only Davy knew how, he shared it with himself. Over the course of the ensuing months Davy would inspire nitrous oxide nearly every day up to several times a day, until he became so fatigued and debilitated that he was compelled to return home to Penzance for a month to convalesce from what was almost certainly a profound macrocytic anemia.[9]

Some of Davy's accounts of nitrous oxide use are more amusing than edifying, such as an episode wherein Davy, having never consumed alcohol in any quantity but alert to the possibility of synergism between the two agents, decided to drink a bottle of wine in the span of 8 min, followed by inhalation of 5 qt N_2O; and it is here that Davy first associates nitrous oxide with emetogenesis.[9] But for our purposes the most important qualities of nitrous oxide are of course its anesthetic properties, and these were next to capture Davy's attention. Prefiguring the close association of dental pain with the advent of anesthesia, Davy writes:

The power of the immediate operation of the gas in removing intense physical pain, I had a very good opportunity of ascertaining. In cutting one of the unlucky teeth called dentes sapientiae, I experienced an extensive inflammation of the gum, accompanied with great pain, which equally destroyed the power of repose and of consistent action. On the day when the inflammation was most troublesome, I breathed three large doses of nitrous oxide. The pain always diminished after the first four or five inspirations; the thrilling came on as usual, and uneasiness was for a few minutes swallowed up in pleasure. As the former state of mind however returned, the state of the organ returned with it, and I once imagined that the pain was more severe after the experiment than before.[9]

In the spring of 1800, while writing in his notebook, Davy interrupted his discussion of nitrous oxide, boxed out two lines of the page with his pen and wrote across it in a large script: "removing physical pain of operations." Finally, in June 1800, Davy would summarize his 18 months of work at the Pneumatic Institute in a monograph entitled *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide*. The 588-page text, densely packed with experimental detail, including the first measurements of the solubility and uptake of nitrous oxide, is remembered today primarily for one brief paragraph, a paragraph that we cannot help but read with a mixture of awe, admiration, wonder, frustration, and disbelief. On page 556 Davy, now 21 yr old, writes:

As nitrous oxide in its extensive operation appears capable of destroying physical pain, it may probably be used with advantage during surgical operations in which no great effusion of blood takes place.[9]

Looking back on Davy's time at the Pneumatic Institute and the startling breadth and depth of his research during less than 2 yr there, one cannot help wondering what he might have accomplished had he been able to continue his work. Even leaving aside his experiments with nitrous oxide, Davy's research in respiratory physiology was visionary, and much of it would not be replicated for many decades. True, in some respects the Pneumatic Institute was an abject failure because it certainly never cured a single patient of disease, but the same charge could be leveled against nearly all of medicine at the time. Nevertheless, Davy would not remain in Bristol for long. In 1801, just 2 yr after his arrival there, he was recruited by two of England's foremost scientists, Royal Society president Joseph Banks (1743–1820, first Baronet) and the enigmatic Benjamin Thompson, Count von Rumford (1753–1814, Count of the Holy Roman Empire), to lead their newly created Royal Institution in London.[14] Davy seized the opportunity.

Davy's Later Life

In London, Davy turned his attention away from respiratory physiology to the new field of electrochemistry, where he was

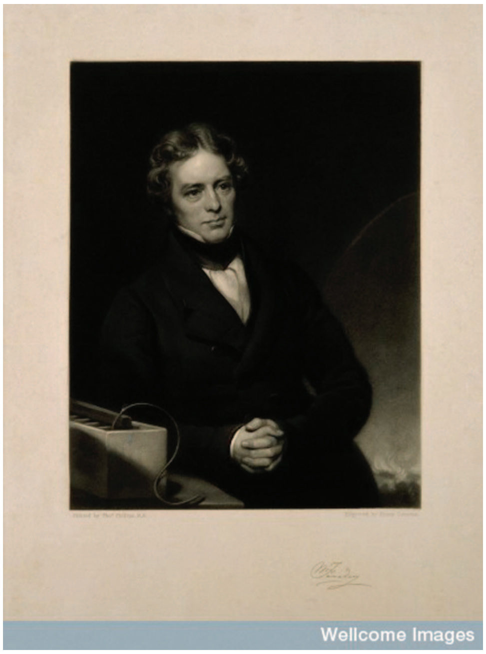

Fig. 2. Michael Faraday, Messotint by H. Cousins after T. Philips, 1842. Image courtesy of the Wellcome Image Library, London, England.

to make perhaps his greatest discoveries. The early electrical experiments of Luigi Galvini (1737–1798, President, University of Bologna) and Allessandro Volta (1745–1827, Professor, University of Pavia) had captured Davy's attention, and Davy astounded both the scientific world and an adoring general public when he realized that Volta's use of chemistry to produce electrical current could be reversed; that is, chemical compounds could be exposed to electrical current and thereby separated into their elemental constituents. Davy quickly hydrolyzed water by this method, then turned his attention to soda ash and potash, from which he isolated sodium and potassium.

Davy's cousin Edmund Davy (1785–1857, Fellow of the Royal Society), himself a noted chemist and later discoverer of acetylene, was present for the first isolation of potassium and recounts Davy's enthusiasm for scientific experiment in indelible detail:

When [*Humphry Davy*] *saw the minute globules of potassium burst through the crust of potash, and take fire as they entered the atmosphere, he could not contain his joy—he actually bounded about the room in ecstatic delight; some little time was required for him to compose himself to continue the experiment.*[4]

Davy's Bakerian Lectures at the Royal Institution at this time were the stuff of legend. Davy and the Institution's sponsors commissioned the construction of the world's largest voltaic pile, consisting of 2,000 double copper plates, directly beneath the main auditorium, so that capacity crowds could react in amazement as Davy turned ordinary soda ash and potash into a silver metal, then quenched his new discoveries in water with a fiery explosion. Soon, no gathering of London society was complete without Davy's presence.

During the ensuing years Davy would use electrolytic experiments to isolate a startling array of elements, not only sodium and potassium but also calcium, strontium, barium, magnesium, boron, and chlorine. His inquiries into chlorine chemistry mark a milestone in our understanding of acid-base reactions: Davy was able to show definitively that hydrochloric acid contains no oxygen, thereby dismantling at last Lavoisier's oxygen (he having named the element "acid-former") theory of acidity. In 1812 Davy was knighted, becoming the first physical scientist since Isaac Newton (1643–1727, President of the Royal Society) to receive this honor.

The Napoleonic wars were ongoing in mainland Europe at this time, and Davy had long wished to visit the European continent and communicate with his scientific colleagues there. Against all odds, in 1813 Davy was able to negotiate passage across the blockaded English Channel, on a prisoner exchange ship. Davy had just married Jane Apreece (1780–1855), and he brought the new Lady Davy with him on the journey. Having recently injured his eyesight in a laboratory explosion, Davy found it necessary to engage an assistant for what he hoped would be a partly scientific expedition, and he chose a young student named Michael Faraday (1791–1867, first Fullerian Professor of Chemistry at the Royal Institution of Great Britain), who would later distinguish himself as the father of electromagnetism. Indeed, Davy is known to have claimed that among his many researches, Faraday was his greatest discovery (fig. 2). In an uncanny example of history repeating itself, Faraday in 1818 would comment on the anesthetic properties of ether, while duplicating his mentor's failure to seize upon the practical significance of this insight.[15]

In 1808, France's Institut National conferred on Davy its "Prix de l'Institut" in recognition of his achievements in electrochemistry. Correspondence between L'Institut and the French Navy at the time reveals that the Channel blockade made it impossible to bestow the prize in person, and thus the medal still awaited Davy as he arrived in Paris 5 yr later.‡

France's leading scientific lights were on hand for Davy's visit, including Joseph Gay-Lussac (1778–1850) and Andre Marie Ampere (1775–1836); Ampere arranged a meeting with the chemist Bernard Courtois (1777–1838), who had in 1811 made a series of observations describing purple vapors rising from acidified kelp ashes. Davy, using portable apparatus and a borrowed voltaic pile, demonstrated chemical similarity of these vapors and those of chlorine and identified them as a new element, which Gay-Lussac would call iodine.[16] Davy then traveled to Italy where he met with Volta before taking up residence in Rome. Napoleon's escape from

‡ The letter, dated March 14, 1808, was sent by a French Marines officer to Jean-Baptiste Delambre, an astronomer and general secretary of the Institut de France. An image of the letter, attributed to an unnamed Parisian archive, is available from the Royal Society of Chemistry at www.rsc.org/images/HDLetter_tcm18-115839.JPG. Accessed January 18, 2011.

Fig. 3. Sir Humphry Davy, Baronet, Thomas Philips 1821. Image courtesy of the National Portrait Gallery, London, England.

Elba in February 1815 and the prospect of further war on the European continent cut short Davy's tour and prompted a hasty retreat to England through Germany.

Upon returning to England, Davy was recruited by a consortium of British coal mine owners to address the question of mine safety. At the time miners simply used open flame to light their work; and as the nascent industrial revolution and England's burgeoning appetite for coal drove mine shafts ever deeper, terrible explosions from the ignition of methane gas became all too common.[17] Davy's involvement began after an explosion at the Felling colliery in Northern England killed 92 men and boys in 1812.[18] Davy quickly established the origins of the explosions and after making a detailed study of their ignition temperatures, realized that an oil-based lamp could safely be used if enclosed in a wire mesh heat exchanger.[19] The Davy Lamp was used well into the 20th century and is credited with saving the lives of countless miners. Davy refused to patent his invention, calling it his gift to humanity. In 1818 he was elevated to baronet, the highest rank ever bestowed on a scientist in the British Empire (fig. 3). Like many scientists whose early years were defined by prodigy, Davy's torrid pace of discovery slowed as he matured, but he remained an active public figure, serving as president of the Royal Society from 1820 to 1826, and he pursued an encyclopedic range of interests, producing important treatises on subjects as varied as soil analysis, leather tanning, and the chemical constituents of pigment samples from Roman frescoes. In each of these areas Davy introduced new analytic methods that would clearly demarcate all research that followed from any that preceded his attention.

Davy nurtured a lifelong love of poetry and was a prolific composer of verse from his youth until just before his death. During his tenure in Bristol, Davy became acquainted with many of the eminent poets of his time, or indeed any time, including Robert Southey (1774–1843, Poet Laureate of the United Kingdom), Samuel Taylor Coleridge (1772–1834), and William Wordsworth (1770–1850, Poet Laureate of the United Kingdom). Coleridge once attended an entire course of Humphry Davy's lectures at the Royal Institution, taking 60 pages of notes. He later remarked: "I attended Davy's lectures to renew my stock of metaphors."[5] It was Coleridge who recruited Davy to edit his and Wordsworth's *Lyrical Ballads* and Coleridge who wrote of Davy "had (he) not been the first chemist, he would have been the first poet of his age."[20] Through his association with the Romantic poets, we can see Davy's life in a broader context that underscores the startling depth and diversity of his activities. That Davy should have participated in both of these equally revolutionary movements is an emblem of his genius and may help us understand how Davy's remarks on nitrous oxide and anesthesia should have been misplaced among his other works.

Davy's penchant for self-experimentation and abiding disregard for personal safety ensured that he would not live to see old age. In 1829, during a visit to Rome, he suffered a stroke and, on May 29th of that year, he died in Geneva while attempting to return to England.[4]

Afterword

Remembering Davy, we are sure to feel some envy at the environment in which his research prospered, with its complete vacuum of regulatory oversight and a seeming abundance of scientific fruit, low-hanging and ripe for plucking. But in Davy's time science as a whole and medicine in particular were perhaps no less confident of their knowledge than now, and the academics of his day would have pontificated with as great a sense of authority and importance as do ours today. Davy shows us that we must focus not only in filling in the gaps of what we presume to know but that we must also revisit our fundamental understanding of the world around us, using new means. Although this might appear a doubtful and even dangerously eccentric task, consider that Davy accomplished much by applying the well-known methods of Priestly, Volta, and others in areas in areas where they had never been thought applicable before. Davy's work thereby foresaw the ongoing transformation of medicine from a dogmatic, speculative discipline into a rational, experimental science.

Although Davy's work on respiratory physiology and nitrous oxide anesthesia had little practical impact in his own time, he bequeathed to us a foundational legacy of scientific inquiry that endures to this day. Morton and Wells rightly deserve our attention for bringing anesthesia into the public consciousness and pioneering its practical application, but Davy's work offers us the first example of anesthesiology as science. In reviewing Davy's achievements, we remember not only that our profession is founded on original experiment and observation, but that these offer us the only sure way forward. Addressing the Royal Institution in 1810, Davy remarked:

Nothing is so fatal to the progress of the human mind as to suppose that our views of science are ultimate; that there are no mysteries in nature; that our triumphs are complete, and that there are no new worlds to conquer.[21]

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