PART ONE

Toward a New Art
"Fabulous" and "vulgar"—such were the epithets used to describe the middle period in nineteenth-century America that saw the discovery of the anesthetizing properties of ether. And fabulous, indeed, was the turbulence of the American scene in the grip of an expanding frontier, rising capitalism and Jacksonian democracy.

In wagons, on barges and on foot, the gaunt, spindle-shanked pioneer, his silent wife and sickly children swarmed over mountain trails and across prairies, along canals and down rivers, to seek an economic and a social independence in the immense lands and forests of the West. A land-hungry and trade-covetous nation set its sights on Mexican territory that encompassed California, Arizona and New Mexico and, without a show of reluctance, fought a war with its southern neighbor that led to the ceding of this territory. Then, while the agents of the governments wrangled over the peace terms in Mexico City, gold was discovered in the American River in California and precipitated a mad rush of fortune hunters to the western El Dorado.

As a result of the invention of the steam engine and machines for spinning and weaving and of improved methods for melting and forging iron in the latter half of the eighteenth century, manufacturing had moved out of the home into the factory, and owners of factories and machines comprised a new class of capitalists of tremendous wealth and secular influence. Encouraged by the new industrialism, men of inventive bent applied their energies to the development of other machines to replace hand labor and to aid commerce and industry. In 1840 alone, 459 patents were granted, and the years between 1830 and 1850 saw the appearance of the Morse telegraph, the McCormick reaper, the harvester, photography, the rotary printing press, Howe's sewing machine and the Bessemer steel process and the operation of over 9,000 miles of railroads.

Women, as well as men, were released from the bondage of the
farm and home economy along the Eastern seaboard, and women took the first step toward proving their equality by moving with the loom into the factory and by flocking to schoolrooms, offices and stores.

With the emphasis on industrialism, the idea of public education gained new significance. By the middle of the century the United States supported over 80,000 public schools with over 3,000,000 pupils, and even schools of religion were supplying boys and girls well enough equipped with secular learning to take part in industrial processes.

The vulgarity of the age was reflected in the greedy and uncritical manner in which homesteaders, mechanics, industrialists and businessmen—reveling in political and philosophic freedom from the restraints of theologic dogma, monarchy, hereditary aristocracy and the European class system—exercised the right to learn and form their own judgment. Belief in the common people, the creed of Jacksonian democracy, made every freeman his own arbiter in matters of politics, religion, law and medicine. In a society set afloat by the rise of capitalism and practical science, by mass immigration of refugees from famine in Ireland and political persecution in Germany and by destruction of the authority of old institutions, there were no bases for judgment and, outside a few citadels of culture along the Atlantic seaboard, the practical, the raw, the noisy, the grotesque, the unique were the things that had popular appeal. It was a time when a President could be elected on a “log-cabin and hard-cider” campaign—a time of circuses and shows, of fakery, quackery and raucous religious revivals.

In keeping with the intoxication and the intemperance of the period was the popularity of “ether frolics” and demonstrations by traveling showmen and itinerant professors of chemistry of the exhilarating effects of breathing nitrous oxide gas. These “benders,” which were common forms of amusement for students of chemistry and the crowd that collected around the offices of young medical practitioners, were direct precursors of the application of ether and nitrous oxide for the elimination of pain in dental and surgical operations. In every case in which priority for the use of these agents to produce anesthesia is claimed, the seed of the idea was planted by experiences in breathing the agents as a means of amusement. And
in every case the man was young, still of an age to seek excitement untempered by prudence, to experiment and to be stirred by strong ambition.*

But a hundred years earlier, at the beginning of the eighteenth century, air and water were still regarded as elements. Subsequently, Joseph Black (1728-1799) discovered that when calcareous earths are heated, they give off a large amount of air. To this he gave the name of "fixed air" (carbon dioxide) and identified it with the "gas sylvestre" that Jean Baptiste van Helmont (1577-1644) had derived from burning charcoal and fermenting beer and from the action of vinegar on shells. Robert Boyle (1627-1691) probably first produced hydrogen from iron filings treated with mineral acid. Henry Cavendish (1731-1810) compared "fixed air" (carbon dioxide) and "inflammable air" (hydrogen), and his experiments definitely established the existence of two gases different from common air.

Nitrous oxide was the discovery of Joseph Priestley (1733-1804), a nonconformist minister, who amused himself by experimenting with "fixed air" in a brewery next to his home in Leeds, England. This pastime led to a deep interest in pneumatic chemistry, and with little knowledge of the subject he isolated and described 9 different gases, among which were "nitrous air" (nitrous oxide) from metals heated with nitric acid (1772) and oxygen from red mercuric oxide heated in a bell-jar over mercury (1774). A poor Swedish apothecary, Carl Wilhelm Scheele (1742-1786), probably prepared oxygen before Priestley.

The exhilarating effect of breathing nitrous oxide gas was discovered by Humphry Davy (1778-1829) at the Pneumatic Institute of Thomas Beddoes (1760-1808), in Clifton, Bristol. Both he and Beddoes encouraged visitors to the institute to breathe the gas and tell how it affected them. Among these visitors were such celebrities as the poets Robert Southey and Samuel Taylor Coleridge, and it soon became fashionable for the laity, as well as students of chemistry, to indulge in nitrous oxide or "laughing-gas" orgies. Davy, also, in reporting his researches on nitrous oxide in 1800, mentioned in his conclusions:

As nitrous oxide in its extensive operation appears capable of destroying

*Crawford W. Long and William T. G. Morton were only 27 when they independently applied ether to eliminate the pain of surgical operations, and Horace Wells was 29 when he used nitrous oxide as a dental anesthetic.
physical pain, it may probably be used with advantage during surgical operations in which no great effusion of blood takes place.\textsuperscript{1}

However, this observation had no effect on the actual discovery of the anesthetizing properties of the gas 44 years later: rather, it was the social use of the gas that brought it to the attention of Horace Wells in 1844.

Sulfuric acid was prepared by the alchemist Geber (fl. 776). About 1540, Paracelsus (1493-1541), who was a student of an ecclesiastic alchemist, distilled sulfuric acid and alcohol and produced sweet vitriol (ether). In experimenting in giving it to fowls, he noted its soporific effect. Ether was also synthesized in 1540 by the German herbalist and botanist Valerius Cordus (1515-1544).

In 1818, Michael Faraday (1791-1867), an assistant to Humphry Davy at the Royal Philosophical Institute and subsequently famous for his work on electromagnetism, called attention to the exhilarating effect of breathing ether vapor. Although Faraday has been credited also with demonstrating the insensibility to pain produced by the inhalation of ether vapor, he, in fact, called attention only to a profound lethargic state that resulted from its imprudent inspiration.\textsuperscript{2}

The idea of using a gas to produce insensibility during surgical operations was advanced in 1824 by an English surgeon, Henry Hill Hickman (1800-1830). Hickman was inspired by a genuine wish to alleviate human suffering and conducted numerous experiments in the administration of carbon dioxide to animals, on which he then performed surgical operations. Despite the fact that his animal experiments were well documented and that he addressed the reports of his research to T. A. Knight, a fellow of the Royal Society of London, and through Charles X of France to the French Royal Academy of Medicine, he received no encouragement. That the insensibility produced by carbon dioxide was asphyxial evidently even did not enter into the lack of consideration given his work. Hickman was, perhaps, a victim of the intraprofessional confusion and jealousy

\textsuperscript{1}Davy, Humphry: Researches, Chemical and Philosophical; Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air and Its Respiration, London, J. Johnson, 1800.

\textsuperscript{2}Faraday, Michael: Effects of inhaling the vapors of sulphuric ether, Quart. J. Sc. and the Arts. Miscellanea (art. xvi) 4:158, 1818.
of the period, manifested by a greater interest in holding ground against the rivalry of irregular practitioners than in new ideas.\textsuperscript{3}

The men who figured prominently in the initial successful application of agents to produce surgical anesthesia were an isolated Georgia physician and two New England dentists, one aided by a traveling showman and a fellow practitioner, and the other, by a geologist and professor of chemistry and by several instrument makers.\textsuperscript{*}

The Georgia physician was Crawford Williamson Long (1815-1878). After being graduated from Franklin College (now the University of Georgia) at 19, he took up the study of medicine: first, under a preceptor in Jefferson, Ga., then at the Transylvania Medical College in Lexington, Ky., for one year, and finally for two years at the University of Pennsylvania, from which he was graduated in 1839. He then spent 18 months “walking the hospitals” in New York City before returning to Jefferson to practice.\textsuperscript{4} There, as he himself told the story:

In the month of December, 1841, or January, 1842, the subject of the inhalation of nitrous oxide gas was introduced in a company of young men assembled at night in this village (Jefferson,) and several persons present desired me to prepare some for their use. I informed them that I had no apparatus for preparing or preserving the gas, but that I had a medicine (sulphuric ether) which would produce equally exhilarating [sic] effects; that I had inhaled it myself, and considered it as safe as the nitrous oxide gas. One of the company stated, that he had inhaled ether while at school, and was then willing to inhale it. The company were all anxious to witness its effects. The ether was introduced: I gave it first


\textsuperscript{*}According to an unsubstantiated instance cited by Keys, in which he refers to a text by Lyman (Lyman, H. M.: Artificial Anaesthesia and Anaesthetics, New York, Wood, 1881, p. 6), William E. Clarke in January, 1842, administered ether from a towel to a young woman named Hobbie at Rochester, N. Y., for the painless extraction of a tooth by a dentist. Clarke presumably got the idea from ether frolics with his friends at the Berkshire Medical College in 1841 and 1842. (Keys, Thomas E.: The History of Surgical Anesthesia, New York, Schuman, 1945, p. 21.)
to the gentleman who had previously inhaled it, then inhaled it myself, and afterwards gave it to all persons present. They were so much pleased with the exhilerating [sic] effects of ether, that they afterwards inhaled it frequently, and induced others to do so, and its inhalation soon became quite fashionable in this county, and in fact extended from this place through several counties in this part of Georgia.

On numerous occasions I have inhaled ether for its exhilerating [sic] properties, and would frequently, at some short time subsequent to its inhalation, discover bruised or painful spots on my person, which I had no recollection of causing, and which I felt satisfied were received while under the influence of ether. I noticed, my friends, while etherized, received falls and blows, which I believed were sufficient to produce pain on a person not in a state of anaesthesia, and on questioning them, they uniformly assured me that they did not feel the least pain from these accidents. These facts are mentioned, that the reasons may be apparent why I was induced to make an experiment in etherization.5

In Jefferson a young fellow named James M. Venable had two small tumors on the back of his neck that he wanted Long to remove, but, because of his dread of pain, he could not bring himself to undergo the operation. Knowing that Venable was fond of and accustomed to inhaling ether vapor, Long told him of receiving bruises without suffering while under the influence of ether. He further suggested the possibility that the operation might be performed without pain and proposed operating on Venable while he was under the drug's influence. This was on March 30, 1842, and on the evening of that day, in the presence of witnesses, ether was given to Venable from a towel, and when he was fully under the influence of the vapor, Long extirpated one of the tumors. Venable gave no sign of suffering during the operation and, when it was over, claimed that he had not experienced the least pain. On June 6, 1842, Long removed the second tumor from Venable's neck under ether anesthesia. His third subject was a Negro boy, whose toe he removed on July 3, 1842.

While Long made no secret of this discovery, for he always operated in the presence of witnesses and urged other physicians to use ether, it did not receive widespread publicity. The nearest hospital, medical journal and railroad were at Augusta, 140 miles away, and the nearest newspaper, a weekly, was at Athens, 20 miles away. Long did not publish an account of his experiences until December, 1849.

In sharp contrast with the isolation of the Georgia community in

which Long worked was the urbanity of New England where two
dental partners, Horace Wells (1815-1848) and William Thomas
Green Morton (1819-1868), demonstrated independently the ap-
plicability of nitrous oxide gas and of ether to the dulling of pain
of surgical operations. New England provided all those incentives
for the ruthless acquisition of wealth and fame that among the
Georgia planters would have been considered an offense against good
taste. In the northeastern section of the country natural science had
been made the servant of machine industry, and there were tempting
possibilities of return to participants in new developments. In Bos-
ton, Hartford, New Haven, Providence and Newport, an area of
marked growth in density of population, a large proportion of the
inhabitants were city-bred and had received college educations. The
section was rich, and its people were ambitious, competitive and
stimulated to the high pitch of intellectual activity that flowered in
the works of Emerson, Thoreau, Cooper, Hawthorne, Irving and
Harriet Beecher Stowe.

To this singular economic and social climate may be assigned the
immediate and widespread publicity given in New England to the
successful use of ether to produce surgical anesthesia, as well as the
commercial motivation that led to the patenting of the preparation
as Letheon. The cosmopolitan character of the section also accounts
for the fact that the public demonstration of ether anesthesia could
be the work of a man of small intellectual attainment and little
nerve, whose success depended on “borrowed” observations, not the
least of these being Horace Wells’s experiences with nitrous oxide.

During 1842 and 1843 when Horace Wells and William T. G.
Morton* were dental partners in Boston, they devised a method for

*It has been variously claimed that Morton was a graduate of the Baltimore College
of Dental Surgery. According to Boland (Boland, Frank K.: The First Anesthetic,
Athens, Univ. Georgia Press, 1950, p. 81), a letter from the dean of the University of
Maryland School of Dentistry avers that Morton did not matriculate at, let alone gradu-
ate from, the school. According to Rice (Rice, Nathan P.: Trials of a Public Benefactor,
New York, Pudney & Russell, 1859, p. 26), he attended the opening of the school in
1840. Morton also is said to have attended lectures at the Medical School of Harvard
University or the Massachusetts Medical College from 1844 to 1846 without receiv-
ing a degree and to have been graduated from the Medical School of Washington
University, Md. The deans of Washington College, Chestertown, Md., Georgetown
University School of Medicine, and George Washington University Medical School all
deny that Morton set foot in their respective institutions. (United States Thirtieth Con-
F. G.: Letter to author dated May 14, 1951; McNally, Paul A.: Letter to author dated
May 22, 1951.) As a student of medicine he did enter his name in the office of a Boston
physician, that physician being Charles T. Jackson.
making dentures that called for the particularly painful procedure of removing all old fangs. To deaden the pain, Morton gave brandy and champagne to the point of intoxication, laudanum in dosages of 100 to 300 drops and opium in masses of 10 to 12 grains. The ineffectiveness of the available pain killers undoubtedly led both men to be on the alert for agents that would produce more profound effects.

The partnership was a failure, and, when the two separated, Morton remained in Boston, and Wells moved to Hartford. At the Union Hall in Hartford, on the evening of December 10, 1844, Gardner Quincy Colton (1815-1898), a traveling showman, put on an exhibition of the effects produced by the inhalation of nitrous oxide gas. A drug clerk who participated in the demonstration gave this account of the events that took place:

I, Samuel A. Cooley, a citizen of Hartford . . . Connecticut, depose and say that on the evening of the 10th of December, in the year 1844, that one G. Q. Colton gave a public exhibition in the Union Hall in the said city of Hartford, to show the effect produced upon the human system by the inhaling of nitrous oxide or laughing gas; and in accordance with the request of several gentlemen, the said Colton did give a private exhibition on the morning of December 11, 1844, at the said hall; and that the deponent then inhaled a portion of said nitrous oxide gas to ascertain its peculiar effect upon his system; and that there were present at that time the said Colton, Horace Wells, C. F. Colton, Benjamin Moulton, and several other gentlemen . . . ; and that the said deponent, while under the influence of the said gas, did run against and throw down several of the settees in said hall, thereby throwing himself down, and causing several severe bruises upon his knees and other parts of his person; and that, after the peculiar influence of said gas had subsided, his friends then present asked if he had not injured himself, and then directed his attention to the acts which he had committed unconsciously while under the operation of said gas. He then found by examination that his knees were severely injured; and he then exposed his knees to those present, and found that the skin was severely abraised and broken; and that the deponent then remarked "that he believed that a person might get into a fight with several persons and not know when he was hurt, so unconscious was a person of pain while under the influence of the said gas;" and the said deponent further remarked "that he believed that if a person could be restrained he could undergo a severe surgical operation without feeling any pain at the time." Dr. Wells then remarked "that he believed that a person could have a tooth extracted while under its influence, and not experience any pain;" and the said Wells further remarked "that he had a wisdom tooth that troubled him exceedingly, and if the
said G. Q. Colton would fill his bag with some of the gas, he would go up to his office and try the experiment," which the said Colton did; and the said Wells, C. F. Colton, and G. Q. Colton, and your deponent, and others . . . proceeded to the office of said Wells; and that said Wells there inhaled the gas, and a tooth was extracted by Dr. Riggs, a dentist then present; and that the said Wells, after the effect of the gas had subsided, exclaimed, "A new era in tooth pulling."6

Wells knew that his former partner, Morton, had contacts in Boston that might prove of value to him in promoting nitrous oxide gas as a pain killer. Consequently, after he had learned from Colton how to make the gas and had to his credit about a dozen successful cases of painless dental extractions performed with the assistance of John M. Riggs (1810-1885), he went to Boston to find out whether or not Morton could get him an introduction to the surgeons at the Massachusetts General Hospital. Morton introduced him to George Hayward (1791-1863) and John Collins Warren (1778-1856) and, according to Wells:

I was invited by Dr. Warren to address the medical class upon the subject. . . . I was then invited to administer it [nitrous oxide] to one of the patients, who was expected to have a limb amputated.

I remained some two or three days in Boston for this purpose, but the patient decided not to have the operation performed at that time. It was then proposed that I should administer it to an individual, for the purpose of extracting a tooth. Accordingly, a large number of students, with several physicians, met to see the operation performed—one of their number to be the patient. Unfortunately for the experiment, the gas bag was by mistake withdrawn much too soon, and he was but partially under its influence, when the tooth was extracted. He testified that he experienced some pain, but not as much as usually attends the operation; as there was no other patient present, that the experiment might be repeated, and as several expressed their opinion that it was a humbug affair (which, in fact, was all the thanks I got for this gratuitous service), I accordingly left the next morning for home. While in Boston, I conversed with Drs. Charles T. Jackson and W. T. G. Morton upon the subject, both of whom admitted it to be entirely new to them. Dr. Jackson expressed much surprise that severe operations could be performed without pain.7

6United States Thirty-Seventh Congress: Third Session, 1862-1863, Senate Reports, vol. 1, nos. 70-107, p. 100.
It is difficult to determine what effect this fiasco for Wells had on Morton's subsequent work with the anesthetizing properties of ether, but it is hard to believe that it was not substantial. While Wells's unsuccessful demonstration had pointed out the vagaries of nitrous oxide for the purpose of dulling pain, it suggested to Morton the obvious possibility of using that agent whose effects were widely known to be similar—ether vapor. In addition, two matters of the many on which Morton consulted Charles Thomas Jackson (1805-

FIG. 1. An example of Morton's ether inhaler.

1880)—a graduate in medicine from Harvard and the Boston geologist and professor of chemistry previously referred to—apparently were related directly to what Morton had picked up from Wells's experiences with nitrous oxide gas. The first of these had to do with the effect of ether when inhaled by college students, an obvious parallel with the use of nitrous oxide gas for entertainment. The second was Morton's use of a glass inhaler, the idea for which he evolved—with the aid of Jackson, two Boston instrument makers (Joseph M. Wightman, later mayor of Boston, and Nathan B. Chamberlain) and a Boston physician and natural scientist (Augustus Addison Gould, 1805-1866)—from an initial attempt to administer ether from an India rubber bag, similar to the one used to hold nitrous oxide gas.

With respect to his debt to Jackson, Morton made certain acknowledgments in a letter to the Académie des Sciences in 1847:

I am ready to acknowledge my indebtedness to men and to books, for all my information upon this subject. I have got here a little, and there
a little. I learned from Dr. Jackson in 1844, the effect of ether directly applied to a sensitive tooth, [*] and proved by experiment, that it would gradually render the nerve insensible. I learned from Dr. Jackson, also in 1844, the effect of ether when inhaled by students at college, which was corroborated by Spear's account, and by what I read. I further acknowledge, that I was subsequently indebted to Dr. Jackson for valuable information as to the kinds and preparations of ether, and for the recommendation of the highly rectified from Burnett's, as the most safe and efficient. But my obligations to him hath this extent, no further. 8

On September 30, 1846, Morton successfully produced anesthesia on himself by the inhalation of ether vapor and was insensible for 7 or 8 minutes. That same evening a likely subject for a conclusive experiment presented himself, one Eben H. Frost, who wished to be mesmerized for the extraction of a tooth. Morton persuaded him to take ether administered from a pocket handkerchief instead, and Frost signed a statement that it put him to sleep and that he experienced no pain whatever.

Thus encouraged, Morton forthwith decided to patent etherization and, through John Collins Warren, to arrange for a demonstration at the Massachusetts General Hospital. By the trial and error method, with the aid of the instrument makers Wightman and Chamberlain and the physician Gould, he got together an apparatus for the demonstration. Henry Jacob Bigelow (1818-1890) described it:

[A] small two-necked glass globe contains the prepared vapor, together with sponges to enlarge the evaporating surface. One aperture admits the air to the interior of the globe, whence, charged with vapor, it is drawn through the second into the lungs. The inspired air thus passes through the bottle, but the expiration is diverted by a valve in the mouthpiece, and, escaping into the apartment, is thus prevented from vitiating the medicated vapor. 9

Then, on October 16, 1846, Morton anesthetized Gilbert Abbot in the surgical amphitheater of the Massachusetts General Hospital, and Warren removed a tumor from the left side of Abbot's neck. The demonstration was successful, and Warren is supposed to have made the now classic statement: "Gentlemen, this is no humbug."

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8Rice, Nathan P.: op. cit., p. 194.
*Ether had been employed as a rubefacient for toothache by William Cullen (1712-1790).
Morton did himself no good in refusing to announce the formula of his preparation; immediately after the demonstration, he came under fire from the surgeons of the Massachusetts General Hospital because it was a secret remedy and was being patented. The hospital totally suspended the use of the preparation until on November 5 Morton agreed to disclose its nature, with the stipulation, however, that the information should be considered confidential. The hospital authorities accepted these terms, and etherization was resumed on November 7. Also, his fellow dentists became aroused and published a manifesto in which they protested "against holding the right to use [ether] on such terms, or as a secret medicine."\(^{10}\) To add to Morton's difficulties, Jackson was prompt in making claims for his part in the discovery, and Morton was prevailed upon by his lawyer to share the profits and to apply for a patent jointly, lest Jackson should impeach it. The futility of Morton's ambitious effort to gain from the commercial exploitation of etherization was crowned when Bigelow, after presenting a memoir on the subject before the American Academy of Arts and Sciences on November 3, read the first paper on etherization before the Boston Society of Medical Improvement on November 9. Bigelow said that he had tested experimentally sulfuric ether, ethereal oil and chloric ether and had decided that the agent was sulfuric ether.\(^{11}\) The upshot was that when the patent on Letheon was obtained on November 12, it could not be enforced, either in America or abroad.

The fate of none of the New Englanders for whom precedence is claimed in the discovery of anesthesia proved to be happy. After petitioning Congress three times without success for a monetary reward for his discovery, Morton spent his last years in abject poverty as a farmer and finally died of an apoplectic seizure. Wells committed suicide, and Jackson ended his life in an asylum for the insane.

After news of the anesthetizing properties of ether had spread from Boston throughout the world,\(^*\) it was only to be expected that other substances would be investigated for their anesthetizing properties.


\(^{11}\)Bigelow, H. J.: loc. cit.

\(^*\)Undoubtedly, the first use of chloroform and ether in military surgery was made during the Mexican War (1846-1848). (United States Thirtieth Congress: Second Session, House of Representatives, Feb. 23, 1849, Report 114.)
James Young Simpson (1811-1870), an Edinburgh obstetrician, on
the suggestion of David Waldie (1813-1889), a Liverpool chemist,
discovered the anesthetizing properties of chloroform and put the
agent to use during November, 1847. Chloroform had been isolated
in 1831 by three independent investigators—Eugène Soubeiran
(1793-1858), Justus von Liebig (1803-1873) and Samuel Guthrie
(1782-1848)—by distilling chloride of lime and alcohol. Chloric
ether, a solution of chloroform in alcohol, had been used by Jacob
Bell (1810-1859) as an anesthetic before February, 184712 and by
William Lawrence (1783-1867) during the summer of 1847.13 Marie-
Jean-Pierre Flourens (1794-1867) had also given chloroform and
ethyl chloride to animals during February, 1847.14

Although experiments were made with other substances and
technics,* these two, ether and chloroform, administered by in-
halation were the only ones in common use until nitrous oxide was
reintroduced as a dental anesthetic early in the 1860's by Gardner
Quincy Colton, the showman who played such a prominent part
in the fortunes of Horace Wells.

12Bell, Jacob: footnote in Squire: On the inhalation of the vapour of ether, and the
apparatus used for the purpose, Pharm. J. 6:350, 1847.
13Coote, Holmes: Surgical operations performed upon patients rendered insensible to
pain by the inhalation of chloroform, Lancet 2:571, 1847.
14Flourens: Note touchant l'action de l'éther sur les centres nerveux, Compt. rend.
Acad. d. sc. 24:340, 1847.

*The Russian surgeon Nikolai Ivanovich Pirogoff (1810-1881) and the Frenchman
Marc Dupuy administered ether by rectum in 1847. (Pirogoff, N. I.: Recherches pratiques
et physiologiques sur l'éthérisation, St. Petersburg, F. Bellizard & Cie., 1847; Proskauer,
C.: The simultaneous discovery of rectal anesthesia by Marc Dupuy and Nikolai Ivanov-