

ETHER ANESTHESIA: YESTERDAY, TODAY AND TOMORROW *

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It was the sixteenth of October in the year 1846. An air of expectancy marked a group of doctors gathered in the operating room of the Massachusetts General Hospital. In the center of the amphitheater, in a chair of heavy construction, sat a patient, Gilbert Abbott, anxiously awaiting the beginning of a surgical operation upon his own body. A tumor at the side of his lower jaw would shortly be treated by the surgeon's knife. The surgeon, Dr. John Collins Warren, stood ready to commence the operation; instruments, ligatures and sutures were ready.

Since the opening of the hospital, twenty-five years before, scores of patients had been led up the narrow stairway of stone to enter the operating room, to be strapped to the operating table and to suffer the pains of surgery without hope or expectation of relief. But on this day, Dr. William Morton, a young man well known in Boston as a practicing dentist and a student of medicine, promised to demonstrate a preparation which, when inhaled, would put the patient so fast asleep that the operation could be done without his experiencing any pain. Strange stories had already been told in the newspapers about this preparation, so wonderful that it could affect consciousness for exactly the time required for a surgical operation and then restore the patient to his normal state. The doctors present were curious but skeptical of the success of the demonstration. Dr. Warren alone seemed to have any confidence in a favorable result.

Young Dr. Morton, late for this most important engagement, hurried up the stone stairway and entered the operating room. He carried a clear glass globe from which a mouth piece protruded. Into the globe he poured liquid from a vial which he took from his pocket. Gilbert Abbott was reassured by a few quiet words, the apparatus was applied to his mouth, and his nostrils compressed by the thumb and finger of Morton's free hand. He inhaled the vapor from the glass globe and soon was seen to fall asleep. Dr. Morton announced that the patient was ready; Dr. Warren commenced the operation. The air of ex-

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pectancy in the operating room was immediately changed to one of intense interest. Instead of the expected struggles and cries of pain, the patient slept quietly while the surgeon cut through sensitive skin, dissected underlying tissues and applied ligatures and sutures. When the operation was completed the patient awoke; he testified that he had felt no pain. Dr. Warren's mind reverted to an occasion four years before this when an attempt to demonstrate painless surgery had ended in failure and the meeting had broken up with cries of "Humbug." He now turned to the speechless audience and said, "Gentlemen, this is no humbug." As they filed from the operating room, young Henry J. Bigelow said, "We have seen something today which will go around the world."

It might have been predicted that this first demonstration of painless surgery would take place in the United States, in the State of Massachusetts and the City of Boston. Seventy years earlier the American Colonies had renounced allegiance to royalty and nobility and proclaimed the idea unheard of for more than a thousand years that all men are created free and equal. In the new republic there were freedom of speech, freedom of belief and, most important of all, freedom of thought. In this movement the people of Massachusetts were in the lead. Education was fostered, useful inventions were made available. Eli Whitney invented the cotton gin, Elias Howe the sewing machine, Samuel F. B. Morse the electric telegraph.

By the year 1846 the Industrial Revolution in New England was in full swing. Following the lead of Samuel Slater at Pawtucket, numerous great mills were built in the vicinity of Boston. To transport raw materials and manufactured products, the Middlesex Canal joined Boston Harbor with the Merrimac River; a network of railroads connected the city with Lowell, Lawrence, Fitchburg, Worcester, and with Maine, New Hampshire, Rhode Island and Connecticut. Coastwise steamers linked the city with all ports along the Eastern coast. The Cunard Line operated regular steamship service between Liverpool and Boston. The people of Boston were commercially busy, financially prosperous.

In literature and in art the city was even more remarkable. On the narrow streets of Boston could be encountered men whose names to succeeding generations would be legendary: Longfellow, Dana, Prescott, Hawthorne, Emerson, Thoreau, Holmes, Whittier, Lowell, Motley, Parkman, Howells, Gilbert Stuart. Boston was first the Capitol of New England, next the Athens of America, finally the Hub of the Universe. Charles Dickens could say, "Boston is what I would have the whole United States to be."

In this exciting habitation we find William Morton, age 16, working as errand boy at the printing establishment of Janes B. Dow on Washington Street, broadening his education by listening to the conversation of the mighty, studying books under the tutelage of Sarah Josepha

Hale, already famous as the Editor of Godey's Lady's Book, sponsor of Bunker Hill Monument, founder of Mariners House and the American Merchant Marine Library. Mrs. Hale testified that Willie Morton was a good boy, pursuing his studies at night and supporting himself with true American spirit.

Morton remained with the Dow publishing house in Boston for four or five years; he advanced from errand boy to clerk in the office. Then he took up a business career, signed a contract with The Pomroy Company, Dealers in East India goods, traveled to the West and opened branches at Rochester, Cincinnati and St. Louis. As a business man he proved a complete failure; he was guileless, unsophisticated; his wiser associates took all that he had and blamed him because he could not get more money from his father. He left a trail of debt wherever he went; finally he was compelled to give up his mercantile career. But this sad experience was not without its benefit; at Cincinnati he personally suffered the pain of a surgical operation, and at Rochester he witnessed the experiments of William E. Clarke, a young chemist who was studying the effects of inhalation of ether vapor.

On his twenty-first birthday, August 9, 1840, a small legacy came due to Morton. With this he would study medicine or, failing this, would practice dentistry. In November, 1840, the Baltimore College of Dental Surgery opened the first dental school in the country. Morton was on hand to attend the opening of the school but there at Baltimore his debts caught up with him. His funds exhausted, he left his trunk as security for his board bill and returned to his father's home at Northside, in Charlton, Massachusetts.

Here then was William Morton, aged 21, a good looking, likeable chap, deeply religious, altruistic, with imagination but lacking in common sense, his first business enterprise ending in devastating failure. But he could study dentistry without the Baltimore College of Dental Surgery. He began study with Dr. Horace Wells, of Hartford, long their family dentist, and with Dr. Nathan C. Keep of Boston, destined to become the first Dean of Harvard Dental School. He opened a dental office in the town of Farmington, ten miles to the west of Hartford.

At the office in Farmington he treated young Elizabeth Whitman, daughter of Edward Whitman who occupied the family mansion on High Street, now a State Museum. Mutual attraction between Elizabeth and the young dentist led to courtship and courtship to marriage, but marriage with a condition—Morton must study at Harvard Medical School and become a regular practitioner.

In October, 1843, Morton opened a dental office in Boston at 19 Tremont Row. The office was on the second floor of a newly erected block of buildings in the center of the city. Here were Papanti's Dancing Academy, Theodore Metcalf's Apothecary, and the Tremont Medical School. Here were painters, daguerreotypists, musicians,

stationers, and the office of Oliver Wendell Holmes, Physician. Across the street were the Boston Museum and the Massachusetts Historical Society.

With the aid of somewhat lurid and certainly unethical advertisements in Boston newspapers, Morton soon gained a large practice and with it the enmity of the local dental profession. But this was only a step in his career. In the spring of 1844 he signed with Dr. Charles T. Jackson, eminent chemist and geologist, as Preceptor. He lived at Dr. Jackson's house on Somerset Street and worked in the laboratory next door. In the fall he matriculated at Massachusetts Medical College. At the dental office an increasing number of assistants helped him to carry on the work. Morton's own problem was to find some way to alleviate the pain of his dental operations. His early attempts met with ridicule, even from his relatives and associates. He decided to conceal his work under a mantle of secrecy. At the successful demonstration on October 16, 1846, Dr. Warren alone knew that the preparation used was sulfuric ether. That evening, in the library of his home on Park Street, Dr. Warren wrote in his Journal, "Did an interesting operation at the hospital this morning, while the patient was under the influence of Dr. Morton's preparation to prevent pain. The substance used was sulphuric ether."

Morton engaged numerous assistants, formed a partnership with Dr. Nathan C. Keep, and devoted his own time to perfecting his method of etherization, devising improvements in his inhaler and obtaining a sufficient supply of rectified ether. He was so engrossed in this work that he could talk of nothing else.

But, as Dr. Holmes said, "Everyone wants to have a hand in a great discovery," and everyone did. Morton chose the name "*Letheon*" to indicate his discovery of "Insensibility to pain during surgical operations." He changed the sign at his office to read, "Dr. Morton's *Letheon* Dental Establishment." The pamphlets which he found time to publish had the heading "Morton's *Letheon*." Dr. Holmes did not approve Morton's choice of the word *Letheon* to describe the great discovery; he suggested the word "*Anesthesia*."

Henry J. Bigelow, soon to become New England's leading surgeon, daily attended the work at Morton's office, influenced the surgeons at the hospital to continue the use of ether in spite of strenuous criticism and opposition, personally administered ether for most of the operations at the hospital, reported the discovery to medical men abroad, read the first paper on anesthesia ever presented before a medical society and published the first scientific announcement of Morton's discovery.

Dr. Charles T. Jackson proposed that he cooperate with Morton to secure a patent on the process of etherization. His attorney, R. H. Eddy, complained that Morton was so busy that it was difficult to see him at all, to say nothing of talking business with him. But finally

the agreement was drawn and the patent granted. It was entitled "Improvement in Surgical Operations."

Dr. J. Mason Warren advocated and used an ether sponge for inhalation anesthesia. Ether sponges were conical in shape, designed to be soaked in liquid ether and applied to the patient's face. Such sponges soon became in great demand; they were sold at five dollars each. They were less expensive than Morton's improved inhalers.

The Massachusetts General Hospital presented Morton with a casket containing a thousand dollars as an appreciation of the benefit of his discovery to the hospital. As a further testimonial, the Physicians and Surgeons of the hospital sent a memorial to the United States Congress, asking a grant of \$100,000 for Morton. The memorial was introduced by Edward Warren, Senator from Massachusetts. It was referred to Select Committees but these committees never reported.

As a result of these activities of his friends, rather than from his own efforts, Morton's discovery became widely known, and its use spread throughout the civilized world. Morton himself stayed quietly at home, attending to his dental practice, administering ether with his improved inhalers. Features of his inhaler were an evaporating chamber on which was mounted a container for liquid ether, an adjusting valve for controlling the flow of ether to the evaporating chamber, a tube of wide aperture for admission of an abundance of atmospheric air, and a mouth piece with a valve for escape of the expiration laden with ether vapor and carbon dioxide. It would be many years before an anesthetic appliance of similar excellence would be devised. Morton used and recommended a slow induction with dilute ether vapor. He knew that the temperature of the liquid ether controlled the rate of evaporation. But he was unable to convince the medical profession of a fact which he knew to be essential to safe and satisfactory etherization—that the patient must continue to breathe an unimpeded supply of fresh air.

In England ether was administered with closed inhalers, with no provision for admitting air except by removing the inhaler from the face. In Germany the ether Rausch was popular; it could be given with an old Derby hat having an ether soaked sponge in the crown. In America an inhaler was made by folding a towel into a large cone and then placing a sponge in its apex. Dr. Laurence Turnbull of Philadelphia, in 1878, gave the following directions for its use, "Ether is then poured upon it with a free hand—half an ounce or more at a time. There will be, at the beginning of the inhalation, attempts to struggle,—which are to be gently but firmly restrained,—and only one or two inspirations of pure air allowed."

At the end of the century there had been little attempt to improve these crude methods of etherization. Ether and chloroform were administered by orderlies, clerks, nurses, often by family physicians. In the hospitals the work was entrusted to the junior interns. Pa-

tients had come to regard anesthesia as a necessary evil rather than as a blessing.

The first great improvement in ether administration was the "drop method," originated by Dr. L. H. Prince of Chicago in 1897. In his original paper, Dr. Prince advocated the giving of ether drop by drop on a modified Esmarch inhaler, with a free mixture of atmospheric air. He stated: "The free admixture of air is an old idea, and has had from time to time, able supporters, but it has not generally been adopted." Ether administration was so improved by use of the drop method that in 1906, Alice McGaw, chief anesthetist at the Mayo Clinic, was able to report 14,000 cases of drop method etherization without a death directly from the anesthetic. The drop method was used by several thousand nurse anesthetists who were employed by hospitals and clinics throughout the country. They were instructed and supervised by the surgeons and their assistants.

It was not to be expected that Morton had chanced upon the ideal agent for surgical anesthesia. Innumerable agents have been introduced to supplant ether; most of them have been short lived. Chloroform was strongly advocated by James Y. Simpson of Edinburgh. It was more potent, more pleasant for the patient and free from the objectionable odor of ether. But chloroform has a distinct toxic effect on the heart; prolonged administration is destructive to the liver. In 1879 the Glasgow Committee of the British Medical Association reported that chloroform was much more dangerous than ether. Propylene, acetylene and ethylene for inhalation; chloral hydrate, pernocton, hedonal, somnifen, sodium amytal and evipal for intravenous use are now mostly forgotten. In extensive use at the present time are nitrous oxide oxygen, cyclopropane oxygen, rectal avertin, intravenous pentothal, divinyl ether and ethyl chloride. Whether any of these will survive will finally depend upon the safety and satisfaction of their administration to the patient. Safety is the factor which has maintained ether in its position of superiority for the past one hundred years.

In America anesthesia was entrusted to nurses; in England and Scotland anesthesia was a recognized medical specialty. Following the lead of John Snow there was a line of eminent British anesthetists including such men as J. T. Clover, Dudley Buxton, and Sir Frederick Hewitt. Early in the present century an attempt was made to organize medical anesthesia in this country.

The first society of anesthetists originated in Brooklyn, N. Y. in 1905. A group of ten or twelve physicians met at the Long Island Hospital and formed the Long Island Society of Anesthetists. In 1911 the Long Island Society was the nucleus of a larger group, the New York Society of Anesthetists. The New York Society was an active one with an increasing membership coming from all parts of the country; by the year 1935 it had become national in scope. In 1936 it was reorganized as The American Society of Anesthetists, in-

corporated in the State of New York. Later the name was changed to The American Society of Anesthesiologists, Incorporated. This active society publishes a bimonthly magazine, *ANESTHESIOLOGY*, and fosters the American Board of Anesthesiology, with headquarters and a library at the Squibb Building in New York City. It has a record of regular meetings over a period of more than forty years, from the organization of the Long Island Society of Anesthetists in 1905 to the present time.

The American Association of Anesthetists was formed at a regular meeting of the American Medical Association at Atlantic City, in June, 1912. At this meeting the Sections on Pharmacology and Therapeutics and on Pathology and Physiology held a symposium on anesthesia. At the close of the scientific meeting a business session was held at which the American Association of Anesthetists was organized. The first president was James T. Gwathmey; the first secretary, William C. Woolsey; the first annual meeting was held at Minneapolis in June, 1913. Regular meetings were held at the time and place of the meetings of the American Medical Association.

In 1922, the American Association of Anesthetists was reorganized as the Associated Anesthetists of the United States and Canada, with five regional societies: the Eastern, Southern, Midwestern, Pacific Coast, and the Canadian Society of Anesthetists. Each year the Associated Anesthetists held an Annual Congress of Anesthetists, sometimes with the American Medical Association, often with the American College of Surgeons. This Association of Anesthetists has an unbroken record of publications from the founding of the American Association of Anesthetists in 1912 to the present time. It includes an Anesthesia Supplement to the *Annals of Surgery*, Anesthesia Supplements to the *American Journal of Surgery*, and finally, the *Current Researches in Anesthesia and Analgesia*.

It was hoped that the Association of Anesthetists would become a Section on Anesthesia of the Medical Association. But the membership of the Association of Anesthetists included dentists, research workers and others who were not eligible for membership in the Medical Association. Furthermore, the Association favored preliminary examination of patients and follow up of results, both of which were unpopular measures. From time to time the American Medical Association held Sessions on Anesthesia in the Section on Miscellaneous Topics. In June, 1940, at the meeting held in New York City, the Section on Anesthesiology of the American Medical Association finally was organized.

Of the many other anesthetic societies which were formed, the Boston Society of Anesthetists was notable as the only American Society with membership limited to full-time anesthetists. The Scottish Society of Anesthetists, which met first at Edinburgh on February 20, 1914, had the same limitation of membership. The Boston Society

was founded in 1920, with Freeman Allen, President, and Lincoln F. Sise, Secretary. The meetings were addressed not only by members of the group but by a wide variety of guest speakers, often of national importance. In this closely knit group, technical, historical and general economic subjects could be discussed with equal freedom. This society was the nucleus from which came the present New England Society of Anesthesiology.

For the eighty-second Ether Day, October, 1928, the Boston Society of Anesthetists arranged a celebration in conjunction with the Associated Anesthetists, the Canadian and Eastern Regional Societies and the American College of Surgeons. The assembled anesthetists journeyed to Mount Auburn Cemetery in Cambridge to place a wreath on the grave of William T. G. Morton. A bronze bust of Morton was presented to the Massachusetts General Hospital in the old amphitheater of the Bullfinch Building. The presentation address was made by Dr. Frank H. McMechan, Secretary General of the Associated Anesthetists. In his usual brilliant style, Dr. McMechan gave an appreciation of the work of Morton, who "for the first time publicly and successfully demonstrated the possibility and value of etherization." If anesthesia were blotted from the world today the whole structure of modern surgery would go crashing into the abyss of oblivion. Of the results gained by organized associations of anesthetists, Dr. McMechan said: "In his day Morton flung us a torch, lit with the fire of his vision and burning with the inspiration of his ideals. In full confidence, I think I may say that this torch—the heritage of future generations of anesthetists—was caught and has been carried by them proudly and with a full measure of achievement."

For the information of anesthesiologists who are contemplating application for certification by the American Board of Anesthesiology, Inc., or who are training physicians for the specialty, the following questions have been employed for Part I (written) examination in the past in *Anatomy*:

1. Give the sensory nerve supply to the scalp.
2. (a) Name the cranial nerves.
(b) Which cranial nerve is most frequently used in regional procedures?
3. From which spinal nerves are the nerves supplying the lower extremity derived?
4. Give the sensory nerve supply of the tongue.
5. Name four branches of the infraorbital nerve and give the area supplied by each branch.
6. Name the structures which the sensory components of the sacral nerves supply.