The Extension of a System

In 1906 James Taylor Gwathmey (1863-1944) said:

Nitrous oxide and oxygen gas is unquestionably the safest anesthetic in the world; anybody studying the subject clinically and theoretically knows that. The only question is that so far they have not been able to use it.¹

Evidently unknown to Gwathmey was the work of a dentist and a surgeon in Cleveland, Ohio, the city that was destined to be the center of interest in a new type of anesthesia as Rochester, Minn., had been in the popularization of the method of open-drop ether.

Nitrous oxide, from the time of Colton's reintroduction of the gas as a dental anesthetic in 1862, had enjoyed great popularity among dentists both at home and abroad. Customarily, a dentist made the gas in his office, even though, about 1871, it had been compressed into cylinders by the Johnson Brothers. The apparatus used by dentists consisted of a retort equipped with a gas burner to generate nitrous oxide from ammonium nitrate. Impurities in the gas coming from the retort were washed out by passing it through water and sulfuric acid. The gas then went into a small gasometer, and from there it was piped directly to the chair in the dentist's operating room.

Although, in 1868, Edmund Andrews had advocated the administration of oxygen with nitrous oxide and the experiments of Paul Bert had shown that pure nitrous oxide anesthesia was asphyxial, most dentists, and medical practitioners as well, held to the belief that 100 per cent nitrous oxide was needed to produce anesthesia. The usual procedure among dentists was to administer nitrous oxide by mask until the patient became slightly cyanotic, remove the mask and extract the teeth. If the patient showed signs of regaining consciousness, the mask was reapplied for a few inhalations.²

²Close, Garth: Personal communication.
Satisfactory as was the method for the dentist and the patient who wanted "painless dentistry," it was fraught with danger, not only of death but also, as has since been discovered, of permanent cerebral damage from anoxia.

A few attempts were made to use nitrous oxide as the induction agent for ether anesthesia, as J. T. Clover had done from about 1871. The advantages of this method were reported in 1901 by Alice Magaw:

On November 26th, 1900 we began giving nitrous oxide gas as a preliminary to ether. Since that time, three months, an anesthetic has been administered in St. Mary's Hospital 394 times, out of which number 289 have had nitrous oxide before ether. In the remaining cases of anesthesia, chloroform was used....We have used this method 245 times....We use the usual dental apparatus, gas bag and cylinder and the method consists in giving the nitrous oxide gas until the patient is unconscious, then changing to ether very quickly and doing away with the nitrous oxide altogether....The initial excitement that follows the first stages of ether inhalation is avoided which is a great comfort to the patient. The time for producing anesthesia is considerably shortened and the quantity of ether is greatly diminished.³

The History of the Boston City Hospital, published in 1906, stated:

Of late years the administration of ether has been preceded by the inhalation of nitrous oxide or laughing gas, as being pleasanter to the taste, and perhaps saving of time.⁴

The difficulty of using unsupplemented nitrous oxide anesthesia for general surgery lay in (1) the inability of the gas to produce by itself surgical relaxation, its effect being primarily analgesic and not anesthetic, and (2) the need for administering it with oxygen to prevent asphyxia.* The apparatus designed for this purpose

⁴History of the Boston City Hospital, Boston, Municipal Printing Office, 1906, p. 265.
*The administration of oxygen with chloroform and also with ether began to attract attention in the last decade of the nineteenth century. Early in 1895 H. L. Northrop reported a large series of cases in which chloroform had been administered conjointly with oxygen. In 1898 Thomas S. K. Morton of Philadelphia reported having used oxygen and ether for inducing anesthesia since December, 1895, in hundreds of cases with but a single accident. Morton adapted an oxygen-inhaling apparatus made by the S. S. White Dental Manufacturing Co. to the administration of oxygen and ether vapor. (Morton, Thomas S. K.: Simultaneous administration of oxygen and ether for general anaesthesia, Ann. Surg. 28:272, 1898.)
proved to be totally inadequate until Frederic W. Hewitt, in 1892, the S. S. White Dental Manufacturing Co., in 1899, and Charles K. Teter, the Cleveland dentist referred to previously, in 1903, devised fairly satisfactory machines.\(^5\)

Teter became interested in developing the apparatus for nitrous oxide and oxygen as well as other anesthetic agents while prac-

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\(^5\)Keys, Thomas E.: The History of Surgical Anesthesia, New York, Schuman, 1945, pp. 84, 110, 111.
The Extension of a System

Teter took the lead in improving nitrous oxide-oxygen anesthesia, and his first machine was manufactured by the Cleveland Dental Manufacturing Co. While others were not slow to jump on the bandwagon, the commercial aspects of the production of satisfactory apparatus and the manufacturing of gases being apparent immediately. J. A. Heidbrink (1875- ), a graduate of the University of Michigan School of Dentistry in 1901, had a personal interest in improving dental anesthesia as a result of suffering from poor anesthesia for tonsillectomy and the extraction of wisdom teeth. When the Teter machine appeared on the market, he bought one and in 1906 revamped it with 2 bread toasters to equalize the pressure in the bags containing the oxygen and the nitrous oxide gas. Other innovations that he made included a rebreathing bag and the installation of an electric light bulb in the mixing chamber to prevent the nitrous oxide from freezing. In 1907, while he was hospitalized for diphtheria, he drew up plans for a machine of his own, the first of the Heidbrink models that are widely used today. Elmer Isaac McKesson (1881-1935), the first physician in Ohio to specialize in anesthesia, also modified the Teter apparatus and in 1910 produced his own machine. In the same year he founded the Toledo Technical Appliance Co. to make and market gas apparatus for anesthesia and other equipment of his own invention. Other machines developed within the decade included those designed by A. C. Clark (1909), Willis D. Gatch (1910), Karl Connell (1911), J. T. Gwathmey and William C. Woolsey (1912), the Ohio Chemical and Manufacturing Co. (1912), Walter M. Boothby and F. J. Cotton (1912) and Richard von Foregger (1914).
Teter, as an able dental anesthetist, soon came to the attention of George Washington Crile (1864-1943), the dynamic surgeon at the Lakeside Hospital in Cleveland. Crile's absorbing interest in diseases of the thyroid gland, particularly Graves's disease (exophthalmic goiter), and the occurrence of surgical shock in operations for the condition motivated him to search for a type of anesthesia that would help to eliminate this surgical complication. Thyroid surgery did not call for the relaxation that was needed in other types of general surgery and provided satisfactorily by ether or chloroform, but rather for a subtle method of putting the agitated patient to sleep. Nitrous oxide-oxygen analgesia, supplemented by local anesthesia with procaine in the field of operation, was the perfect answer and was adapted eventually by Crile for all types of general surgery.

Crile gave full credit to Teter for his introduction to nitrous oxide-oxygen anesthesia:

My first attention clinically was called to nitrous oxide by the work of Dr. Teter, who had acquired a splendid empirical knowledge of the administration of nitrous oxide in his dental work, and invented an excellent apparatus bearing his name. A few administrations of this anesthetic by Dr. Teter were sufficient to indicate its clinical possibilities.

However, it was not Teter nor another dentist nor a physician to whom Crile turned to find an administrator of nitrous oxide-oxygen anesthesia, but a nurse, Agatha Hodgins. While attending surgical clinics at St. Mary's Hospital, he had seen the skillful work of the Mayos' nurse anesthetists, and, also, he was well aware of the satisfactory service of a nun at the St. Vincent Charity Hospital in Cleveland, Sister Mary Coletta Fleming (d. 1918).

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†"When I entered medical school fifteen years before the close of the century... [the] administration of anesthetics was in the crude stage in which the youngest, the most inexperienced, the strongest house doctor was called upon to hold down the patient. Administering an anesthetic resembled more a feat of strength than an art. Once the patient was under the influence of chloroform or ether, the surgeon had no recognition of his responsibility in regard to surgical shock, for there was no knowledge of shock beyond the fact of the great facility for its production.” (Crile, Grace, Ed.: op. cit., vol. 1, p. 18.)
who was assigned to anesthesia in 1906 and was anesthetist for Carl A. Hamann (d. 1930) and Frank E. Bunts (1861-1928).

Agatha Cobourg Hodgins (1877-1945) was a native of Toronto, Canada. The report of the Boston City Hospital Training School for Nurses, which she entered as a probationer on February 23, 1898, to graduate on March 4, 1900, speaks of her as being quiet and self-possessed in manner. She proves herself to be intelligent, amiable, and well bred. She is happy in her work and seems well adapted for the care of children.... Miss Hodgins might be considered an excellent nurse. She has always done her best. She is punctual, frank, tidy, and very patient.11

However, to her classmates, the tiny, round-faced, quiet, non-aggressive Agatha, with her ultra-Canadian ways, seemed to be destined for no great accomplishment.12 Two of these classmates, Calvina MacDonald and Mrs. Russell Birge, moved to Cleveland. In 1900 Agatha followed them and became employed as head nurse on the private pavilion at Lakeside Hospital.

One morning in the spring of 1908 Crile, as he tells the story in his Autobiography,
drew Miss Hodgins aside and presented to her what amounted to an annunciation. She had received no warning whatever about the plan to make her my special anesthetist, but she told me promptly that she would undertake it if I would remember always that she was giving her best.... Miss Hodgins and I had our own experimental school. In order that she might become familiar with the symptoms of death, I started her to work administering anesthetics to rabbits and dogs. From anesthetizing rabbits, she learned to anesthetize young babies. Her skill in amusing them with toys or my watch while she allowed the gas to play gently over the child's face until the sandman closed his eyes and he slipped back on the pillow was extraordinary.... In the beginning the interns were none too willing to relinquish the work to a nurse. One day I came upon an intern putting a big, six-foot patient under an anesthetic while Miss Hodgins struggled to hold the patient down. On my suggestion he reversed the order of the procedure. This was one of Miss Hodgins' earliest anesthesias.13

Not only under Crile's tutelage, but also on her own Agatha Hodgins learned all that there was to know about anesthesia. She

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11Boston City Hospital School of Nursing: Personal communication.
12Harris, Ida May: Personal communication.
read all that she could find on the subject and broadened her clinical knowledge in every way possible. Night after night she walked the wards where she listened to the sleeping patients' breathing in order that she might detect subtle differences.14 And, as many others had done and were still doing, during her first year as Crile's anesthetist, she visited the Mayo Clinic to observe the technic of administering open-drop ether.

On the basis of Agatha Hodgins' experiences with both ether and nitrous oxide-oxygen anesthesia, Crile made a comparison in a report published in 1909:

My general anesthetist, Miss Hodgins [sic], gave the anesthetic in the experimental laboratory, and there acquired an excellent working knowledge of it. Miss Hodgins [sic] has administered nitrous oxide in 575 major operations, and has kept careful notes. She had had a large previous ether experience, with which comparisons were made. . . . It was only after considerable experience that Miss Hodgins [sic] was able to so skilfully adjust the dosage as to keep the patient under the anesthetic sufficiently for surgical purposes while maintaining a pink circulation.

That others were working along the same lines was indicated by the discussion in which Howard Atwood Kelly (1858-1943) of Baltimore participated:

When I was in Philadelphia twenty-two years ago I bought from F. W. White an apparatus for administering nitrous oxide, and I took it with me to Baltimore, where I secured the services of a dentist who specialized in giving this anesthetic for the purpose of extracting teeth. He administered the anesthetic for me, but found it hard to keep the patient profoundly under its influence. . . . The only difficulty is it takes an anesthetist who is more skilled in its use than in the administration of ether. Some men never learn to administer nitrous oxide as it should be given. They do not get patients completely under its influence. But nitrous oxide with oxygen, and then the addition of a little ether occasionally, in my mind is an ideal anesthetic. Dr. Warren Buckley has worked out all these problems for me in my private hospital.15

By 1911 Crile was able to report to the American Surgical Association on 10,787 surgical operations which he performed using either ether or nitrous oxide anesthesia supplemented by ether

14Shupp, Miriam G.: Personal communication.
with no anesthetic death. That same year an article on the work being done in Cleveland appeared in the American Journal of Nursing:

Many of the best surgeons in America are employing graduate nurses as their anaesthetists, notably among them being the Drs. Mayo of Rochester, Drs. Murphy, ... and Ochsner of Chicago, and Dr. Crile of Cleveland. ... After daily observation for several weeks of the administration of nitrous oxide gas and oxygen, at the clinic of Dr. Crile at Lakeside Hospital, and after witnessing, as a private student, nearly 100 gas-oxygen anaesthesias by Dr. Charles K. Teter, of Cleveland, I am convinced that this gas-oxygen method ... is ... safest of all anaesthetics in the hands of an expert, and the most dangerous in the hands of one not an expert. Dr. Crile refuses to allow an interne to give the gas-oxygen and insists upon its administration by his specially-trained and experienced graduate nurse.

As had been true of the Mayo Clinic with respect to open-drop ether anesthesia, the Lakeside Hospital became the mecca for students of the nitrous oxide-oxygen technic.* In this phase of the

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* At the convention of the American Hospital Association in 1913 the question was asked, "To what extent is anesthesia by nitrous oxide gas displacing ether?" F. A. Washburn of the Massachusetts General Hospital replied: "The Lakeside Hospital at Cleveland is using gas and oxygen to a very great extent; to so great an extent that they manufacture their supply and have their operating anesthesia rooms piped. The method with them gives the greatest satisfaction. ... The patient gets under without much discomfort and comes out without much discomfort. They say that the whole attitude of the patients toward an operation has changed since they introduced gas and oxygen anesthesia. The objection to it, as I understand, from the surgeon's point of view is the fact that they do not always get complete relaxation of the muscles. We have done it to quite an extent at the Massachusetts General Hospital, but on selected cases. It is one of our recognized methods of anesthesia and it is increasing in proportion, I think, each year, but we have not adopted it on any such widespread scale as the Lakeside Hospital. I cannot speak for the other hospitals." (Tr. Am. Hosp. A. 15:463, 1913.)

At the same meeting there was further discussion of the methods of anesthesia used at the Lakeside Hospital: "Dr. Crile, as you know," said J. N. E. Brown, "practices what is called the ... [anoci-association] methods—a word invented by himself. Briefly they consist first of all of giving the patient an injection of morphia and atropine. The patient comes to the operation with the greatest confidence in Dr. Crile himself, one of our most skilful surgeons in America; is put in the proper mental condition, so far as the anaesthetist and surgeon operating is concerned (which means a great deal). As Dr. Crile proceeds with his operation he injects into the skin and into the muscular tissues and into the peritoneum, novocaine. It was surprising to me to see how many injections he gave. They were administered rapidly, the nurse standing by holding the syringe ready for him. When the operation is over he follows up by another injection of morphia and atropine. The general anaesthetic is oxygen and nitrous oxide, the patient is under in a few moments, and just in a very few minutes after the anaesthetic is discontinued, the patient is out from under the anaesthetic
development of anesthesia Agatha Hodgins played a leading role. One now-famous surgeon, who as a student went to Cleveland to learn the technic, was admonished by his chief: "George will talk a lot, but you watch Agatha."

What was apparent in many places was an increasing acceptance of the conviction of Arthur Dean Bevan (1861–1943) that:

Women... make the best anesthetists just as they make the most reliable and conscientious operating-room nurses. In these days of modern surgery, the responsibilities and the functions of the skilled anesthetist and the head surgical nurse are little less important than those of the operator himself.18*

In several well-known and reputable hospitals women per se, neither nurses nor physicians, demonstrated the peculiar qualifications of that sex for the work. J. Marie Gronvold (1875-1948), the first anesthetist at St. Joseph's Hospital, St. Paul, was neither a nurse nor a physician, although later she was admitted to membership in the American Association of Nurse Anesthetists. After attending lectures at the University of Minnesota Medical School she left the university to become employed by Arnold Schwyzzer (d. 1944) and Frederick C. Schuldt (1875- ), who taught her anesthesia on-the-job at St. Joseph's Hospital in 1903. She worked there until her death, in 1948, and, during the years, trained Sister Mary Charles (1876- ) and Ethel Fitzgerald (1888- ), the first nurse anesthetists in the hospital, as well as other nurses, student nurses and interns.19 During the first decade of the century another lay anesthetist was Emma J. Ochsner (1876- ), a sister of A. J. Ochsner and Edward H. Ochsner. She gave instruction in the drop-ether technic at the Augustana Hospital in Chicago and sub-

and lively as a cricket—no nausea, no bad after effect whatever. Dr. Crile's theory is that many patients without such precautions suffer injuriously from shock of the nervous system. His idea is that that shock may be caused by the ether, chloroform, or whatever anaesthetic is given, and it may be further increased by the incisions made in the abdominal wall, or by the manipulation of the intestines.” (Tr. Am. Hosp. A. 15:283, 1913.)

19Sister Saint James: Personal communication.

*That Bevan favored women physicians as anesthetists is indicated by an affidavit sent to A. T. McCormack, secretary of the State Board of Health of Kentucky in 1917, in which he wrote: "The solution of the problem involved lies, as far as the trained nurse is concerned, in having the talented nurse, who desires to become an anesthetist, study medicine and become licensed.” (Kentucky M.J. 15:149, 1917.)
sequently received a Government appointment as an anesthetist.\textsuperscript{20}

She wrote:

My brother, Edward, after being given an anesthetic by Miss Alice Magaw was so impressed by the skillful way the anesthetic was administered he asked Dr. Mayo whether he would be willing to have her teach me. Dr. Mayo replied by letter, “We will teach Emma every dern thing we know!” In January, 1906, I began giving anesthetics for my brother, Edward, at the Augustana Hospital and continued until June 29th, 1910.

Some time before this, my brother, Dr. Albert J. Ochsner, told me he had been asked to recommend an anesthetist for the New Philippine General Hospital and if I was interested I should apply for the position. I did so, and received a letter from Washington, D. C., telling me the position had been placed under Civil Service and instructions would follow. I thought I probably would not make the grade, but felt if I did get the position, no one could accuse me of getting it because I was the sister of two famous surgeons. Then in January, 1911, a letter came from Washington, D. C., informing me I stood at the top of the list of applicants, numbering more than one hundred. I was very much surprised. On March 31, 1911, I gave my first anesthetic at the Philippine General Hospital in Manila and the last ones on April 30, 1913.\textsuperscript{21}

By the second decade even the conservative East had capitulated to nurse anesthesia.\textsuperscript{*}

\textsuperscript{20}Schjolberg, Amy O.: A History of the Augustana Hospital School of Nursing, 1884-1938, Chicago, Alumnae Association of the Augustana Hospital School of Nursing, 1939, p. 75.

\textsuperscript{21}Ochsner, Emma J.: Personal communication.

\*Available records show a preponderance of nurse anesthetists in Midwestern hospitals through the first decade of the century. In addition to those already mentioned, the following nurses were employed by hospitals during this period:

1900. Sister Mary Valentine (d. 1947) at St. Joseph’s Hospital, Aberdeen, Wash.; Sister Mary Anna (d. 1934) at St. Joseph’s Hospital, Joliet, Ill.

1902. Nellie G. Davis (1883— ) at Soules Hospital, Westfield, N. Y.; Myra L. Sawyer (1883— ) at the State Hospital, Hazleton, Pa.

1903. Gertrude N. Pringle (1880-1948) at Samaritan Hospital, Sioux City, Iowa; Sister Clementine Dale (d. 1941) at St. Joseph’s Hospital, Deer Lodge, Mont.; Sister Monica Schulte (1879— ) St. John’s Hospital, Springfield, Ill.

1904. Sister Caroline Pepmeier (1879— ) at Evangelical Deaconess Hospital, St. Louis, Mo.; Sister Mary Laetitia Musil (d. 1920) at Mercy Hospital, Iowa City, Iowa; Sister Helen Quirk (d. 1926) at St. Mary’s Hospital, Duluth, Minn.

1905. Sister Mary Antonia at St. Anthony’s Hospital, Carroll, Iowa; Sister Mary James Rice (1886— ) at Mercy Hospital, Big Rapids, Mich.; Sister Helen Smith at St. John’s Hospital, Helena, Mont.; Sister Onesima Dasenbrock (1881— ) at St. John’s Hospital, Springfield, Ill.

1907. Sister Mary Romana at St. Joseph’s Hospital, Joliet, Ill.; Eleanor Hamilton at St. Barnabas Hospital, Minneapolis, Minn.; Emily McCreight at Robert Packer
Hospital, Sayre, Pa.; Jane R. Foshay (1883- ) at Melrose Hospital, Melrose, Mass.; Sister Mary Thomas Wilson (1880-1940) at Mercy Hospital, Council Bluffs, Iowa.

1908. Sister Mary Salome at St. Vincent's Hospital, Sioux City, Iowa; Sister Marie Fidelis at Roselia Maternity Hospital, Pittsburgh, Pa.; Anna Pettingrill at Deaconess Hospital, Freeport, Ill.; Mother Raphead at Mercy Hospital, Charlotte, N. C.; Bertha McKeen (1879- ) at Passavant Hospital, Pittsburgh, Pa.; June C. Roberts (1888- ) at Latter Day Saints Hospital, Salt Lake City, Utah; Mae B. Cameron at Ravenswood Hospital, Chicago, Ill.; Sister Mary Lelia at Mt. Carmel Hospital, Pittsburg, Kans.; Virginia Monroe as a private nurse anesthetist in New Orleans, La.; Sister Dora Lundborg and Sister Margit Lietvedt at the Lutheran Deaconess Hospital, Minneapolis, Minn., the former trained in Lund, Sweden, and the latter in Oslo, Norway; Jane Florence Perry (1868- ) at Latter Day Saints Hospital, Salt Lake City, Utah.

1909. Sister Mary Amalia (d. 1949) at St. Joseph's Hospital, Joliet, Ill.; Bertha M. Ghent at Mounds Park Hospital, St. Paul, Minn.; Mother Magdalene Wiedlocher (1889- ) at St. John's Hospital, Springfield, Ill.; Florence Thompson (1889- ) at Augustana Hospital, Chicago, Ill.; Agnes McGee (1885- ) at St. Vincent's Hospital, Portland, Ore.

1910. Sister Mary Agnes, St. Vincent's Hospital, Sioux City, Iowa; Sister Mary Angelica Sears (d. 1950), Sister Mary Carmelina Nash and Sister Mary Collete Miller (d. 1950) at Providence Hospital, Holyoke, Mass.; Sister Mary Euphrasia McMahon (d. 1929) at Mercy Hospital, Springfield, Mass.; Sister Mary Sacred Heart Donahue (d. 1945) at St. Vincent's Hospital, Worcester, Mass.; Elizabeth Nagel at Elizabeth Buxton Hospital, Newport News, Va.; Sister Gervasie Kokancek, St. John's Hospital, Springfield, Ill.; Deborah Richter at Madison General Hospital, Madison, Wis.; Sister Mary Vincent at Miles City Hospital, Miles City, Mont.; Sister Thomas at Mercy Hospital, Des Moines, Iowa; Laura D. Bryant at Cooper Hospital, Camden, N. J.; E. Mae Jones (1886- ) at Rawlings Sanatorium, Sandersville, Ga.; Sister Mary Bernard (1884- ) at St. Francis Hospital, Breckenridge, Minn.; Sister Mary Xavier Reeves (1879- ) at St. Mary's Hospital, Duluth, Minn.; Sister Mary Josephine at St. Joseph's Hospital, Aberdeen, Wash.; Mary Johnson (1887- ) at Northwestern Hospital, Minneapolis, Minn.; Margaret Church in Fort Wayne, Ind.

Of these, it is known that the following nurse anesthetists went to the Mayo Clinic to observe: in 1907, Eleanor Hamilton; in 1908, Mae B. Cameron, at the suggestion of G. W. Green at the Ravenswood Hospital, Chicago, who taught her initially and had been to Rochester; in 1910, Margaret Church; in 1910, Mary Johnson and, in 1912, Sister Mary Angelica Sears and Sister Mary Carmelina Nash.

In 1913, the influence of the Mayos in using nurse anesthetists extended to the Southeast. That year Zola Lucretia Thomas (1890-1948), a graduate of the Home and Retreat Hospital School of Nursing in Lynchburg, Va., became chief nurse anesthetist at the Grady Memorial Hospital in Atlanta, her training in anesthesia having been received at the Mayo Clinic. (Mrs. Edgar D. Shanks passes, J.M.A. Georgia 37:60, 1948.)

In addition to the dentist or physician anesthetists already mentioned in this work, the following were practicing during the early part of the century: in 1900, Charles L. Leonard at the Philadelphia Hospital; in 1902, Dr. Killani at the Lenox Hill Hospital, New York City, and A. H. Bingham at Metropolitan Hospital, New York City; in 1903, Myron Metzenbaum at the Mt. Sinai Hospital, Cleveland, and M. L. Maduro and M. P. Denton at the Mt. Sinai Hospital, New York City; in 1910, William H. Doran and Charles S. Hunt at the New York Polyclinic Hospital, New York City, and Nathaniel Morse at the Carney Hospital, Boston; in 1912, Grace Clark at the Woman's Hospital, Detroit; Ansel Caine, New Orleans; Frank H. McMechan, Cincinnati; Arthur Guodel, Minneapolis; Charles Lawrence and Monte Reid, Atlanta, Ga.; Claude Cleveland, Mobile, Ala.
In 1904 Alice Maude Hunt (1880- ), an Englishwoman who became the first nurse anesthetist to receive a faculty appointment in a university medical school (see Chap. 6, pp. 101-102), was graduated from the Union Hospital Training School at Fall River, Mass. Her first position was in Philemon E. Truesdale’s (1874-1945) hospital in Fall River, where in the year 1908 chance directed her into the specialty of anesthesia. D. R. Ryder, who had been Truesdale’s anesthetist, decided to devote himself to otolaryngology, and Truesdale, having seen the successful administration of anesthesia by nurses at the Mayo Clinic, asked Alice Hunt to take over Ryder’s work. After Ryder introduced her to the technic of administering open-drop ether, she spent a week at the Mayo Clinic and then went to Albert Miller in Providence, R. I., to learn how to give the nitrous oxide-ether sequence.\(^2\) (See Fig. 16.)

In Boston, during this time, the anesthesia service at the Massachusetts General Hospital underwent a radical change.

At the turn of the century, anaesthesia at the Massachusetts General Hospital was principally performed by the administration of ether by House Officers through the inhalation method. The youngest Surgical House Officer was known as the Etherizer. He learned in the hard school of experience. There was some instruction by junior surgeons, but not much.

In the 1903 Annual Report of the Visiting Staff we read: “The importance of a careful supervision of the administration of anaesthetics during surgical operations has been felt more strongly of late years, and this feeling has resulted in the appointment of an anaesthetist to the Hospital. This work has since been more carefully systematized, and proper instructions have been given to those whose duty it is to give the anaesthetics. New and improved methods of administering anaesthetics are from time to time introduced.” In this year Dr. Freeman Allen was appointed Consulting Anaesthetist. His duties were mainly the instruction of House Officers and the administration of the anaesthetic in difficult cases or where new methods were tried.

Dissatisfaction among the surgeons with anaesthesia administered by House Officers came to a head in 1909, when Dr. Charles L. Scudder and Dr. James G. Mumford were appointed a Committee upon Anaesthesia. They sent a circular letter to twenty-six prominent hospitals. Their summary of the information received was to the effect that most hospitals used house officers for the giving of anaesthesia, that there was very little instruction of house officers or students, that the method was unsatisfactory. A few of the hospitals, notably the Lake-

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\(^2\)Hunt, Alice M.: Personal communication.
side Hospital in Cleveland, O., St. Mary's Hospital in Rochester, Minn., and the Mercy Hospital in Chicago, employed graduate nurses as anaesthetists. They found this system satisfactory. . . . The recommendation of the Committee was "the establishment of paid nurse anaesthetists, one for each surgical service." This recommendation was adopted in 1909.23

The two nurses affected by the recommendation were Helen Altimus and Grace Perkins, both graduates of the Massachusetts General Hospital School of Nursing in 1907. One was assigned to the East and the other to the South Surgical Service. In January, 1913, Catherine Conrick was assigned to a similar position on the West Surgical Service after being etherizer on the accident service.24

For some years previous, students in the Massachusetts General Hospital School of Nursing had received instruction in anesthesia. According to the report of the training school for nurses in the annual report of the hospital for 1907:

This instruction this year has been given by Dr. Allen, the Anesthetist to the Hospital. Under his personal direction, the nurses receive much more practical instruction than by the former method.*

In 1908 and 1909 the reports stated:

A lecture is given to the class on the fundamental principles of surgical anesthesia and the methods of its production. During the year each nurse then receives at least twice individual instruction in the actual administration of ether to patients for surgical operation, and is also taught the manufacture of cones and the care of ether patients.

And from the report for 1911:

Two nurses act as anesthetists and the staff of pupil assistants has been increased by three, making a total of six pupils.25

In 1911 Freeman Allen evaluated the change in "A Review of Ten Years' Work in Anesthesia":

During my term of service up to the present time, we have tried more or less thoroughly various forms of nitrous oxide, ether and chloroform inhalers, various mixtures of chloroform, ether and ethyl

\begin{footnotes}
24Sleeper, Ruth: Personal communication.
*Until 1934, a 3-month course in anesthesia was given to selected students in the Massachusetts General Hospital School of Nursing.
\end{footnotes}
chloride, somnoform, ethyl chloride, rectal etherization, gas and oxygen anaesthesia, spinal anaesthesia and are now beginning intravenous anaesthesia. . . . It is a very difficult problem to obtain satisfactory routine anaesthesia. The anaesthetizing term of service of the house-pupils is so short that they only begin to develop a reasonable amount of skill when they are required for other work. I find, too, that only about one man in five takes any real interest in anaesthesia. I have found the best system to be to use nurses as anaesthetists. They are often willing to stay at the hospital one or two years at a moderate salary. Some of them develop a good deal of skill, while others improve very little. Of course the ideal system for a big hospital would be to have a resident salaried male anaesthetist who would have under his immediate control and training several deputy anaesthetists.26

In 1916 a chief of nurse anesthetists was appointed and that summer made a long stay in Cleveland . . . and thoroughly investigated the method of administering anaesthetics, especially nitrous oxide and oxygen, in the clinic of Dr. G. W. Crile, at Lakeside Hospital, bringing back some new and important technical details.27

The same year that nurses received appointments as anesthetists at the Massachusetts General Hospital, similar innovations were taking place in Philadelphia. One of these changes was described by J. M. Baldy in the American Journal of Obstetrics in 1909:

The time-honored custom in hospitals of utilizing the junior resident physician in this capacity [of anesthetist] has proven itself not only a failure, but a disaster in many instances. The equally unscientific use of the nearest practising physician in surgery in private houses has proved itself similarly unfit. . . . The perfect solution, of course, would be a medical man of high grade of intelligence, with a well-grounded medical and surgical education, a special education in anesthetics supplemented by a natural inclination in this direction as against any other. Are the attractions of anesthesia sufficient to overcome the disadvantages of the scientific narrowness and lack of opportunity for distinction and income to hold a sufficient number of men of this type or even of great worth in this field? The answer seems apparent. . . . The Gynecæan Hospital of Philadelphia has now had a graduate nurse in charge of its anesthesia (independent of all aid) for a year. . . . My proposal originally was met by the universal opposition of everyone connected with the hospital. . . . A nurse about to graduate was selected and turned over to the anesthetist (a physician . . .) for instruction during the remaining months of her nursing course. . . . The

27Ibid.
result has been to win without exception the approval of everyone about
the institution. . . . We note in a recent report of St. Mary's Hospital,
Rochester, Minn., that the Mayo Clinic has four official anesthetists—
all women. It was in this clinic we were first impressed with the capacity
of a woman in this position.28

Also during 1909, J. William White (1850-1916), chief surgeon
of the University of Pennsylvania Hospital, underwent an operation
at St. Mary's Hospital in Rochester, Minn., and upon his return to
Philadelphia reported to the Board of Managers on the impressive
work in anesthesia being done by the Mayos' nurse anesthetists.29
Subsequently, through the efforts of Charles H. Frazier (1870-
1936), then professor of clinical surgery, a nurse was appointed anes-
thetist to the General Surgical Clinic. This was Anna Marie Sophie
Rose (1876- ), a native of Denmark and a graduate of the Hospital
of the University of Pennsylvania Training School for Nurses in
1905. In 1916 when she left the hospital to accept a similar position
at the Lying-In Hospital in New York City, this acknowledgment of
her work was entered in the records (See Fig. 18):

Miss Marie Rose was the first of her profession in Philadelphia to be
recognized as an official Anesthetist and by her mastery of the many
methods of administering anesthetics, she has demonstrated to the Sur-
gical Staff of the University Hospital the value of the Professional Nurse
Anesthetist. Especially because of her skill in the administration of N₂O
anesthesia for major operations she contributed notably to the comfort
of her patients and to the reputation of the Clinic, and by her sys-
tematic instruction of nurses who came from other hospitals for post-
graduate training she has widened the influence of the Clinic. For these
reasons and because of Miss Rose's efficiency and her devotion to duty
throughout the years of her service, the Board of Managers of the Hos-
pital of the University of Pennsylvania spreads this memorandum of
their appreciation upon its minutes.30

Also in Philadelphia, on January 31, 1910, the secretary of the
staff of the Pennsylvania Hospital, James P. Hutchinson, addressed
a letter to the secretary of the Board of Managers, John T. Lewis:

The Surgical Staff of the Pennsylvania Hospital are unanimously
agreed that the best interests of the Hospital should be served by em-
ploying a woman anaesthetist. She should not be a physician because

29Margison, Mathilda M.: Unpublished manuscript.
30Stephenson, Mary V.: The First Fifty Years: Training School for Nurses, Hospital
any physician so employed only takes the position and holds it as a means of further advancement and drops it as soon as she can better herself and a woman other than a physician so employed would feel that it was a permanent occupation and would conscientiously advance in usefulness in her employment. In the Hospitals where the plan has been tried it has been found universally satisfactory. It is the feeling of the Surgical Staff that some one of the many efficient nurses that have been trained in the Hospital could ably fill the position.\textsuperscript{31}

This suggestion for the employment of a woman anesthetist was referred to the Attending Managers to formulate a plan and report at the next meeting. After several referrals back to committee, the Board got down to business on May 31, 1910:

The committee on Female Anaesthetizer appointed at the last meeting with power to act and fix salary report that Dr. James P. Hutchinson, Secretary of the Staff notified it that the Surgical Staff recommended Miss Eva M. McNinch [of the class of 1901 of the Pennsylvania Hospital Training School for Nurses] to fill the position of Anaesthetist.

Your committee had an interview with her on 5th mo. 19th and immediately appointed her to the position on the following understanding:— That she will have a room assigned her in the Nurses' House with meals at the Head Nurses table in the same building.

That she will be subject to the general control of the Superintendent, and as to House Rules, to the Matron and Chief Nurse.

Her salary has been fixed at $50.00 a month for the first six months and then to be increased $5.00 and so on every three months until a maximum of $75.00 is reached. Her duties as Anaesthetizer are to be subject to the call of the Surgical Staff.

If time and opportunity allow, she is to take charge of the lighter duties of the Rayographist. The heavier work in this line must be performed by more experienced operators, employed from time to time as wanted and as is now done.\textsuperscript{32*}

In 1910 at still another Philadelphia hospital, the Lankenau Hospital, a nurse was appointed to the position of anesthetist. This was Elizabeth Rapp, who, in 1905, graduated from the Lankenau Hospital Training School for Nurses. She was approached by the

\textsuperscript{31}\textit{Pennsylvania Hospital Minutes of Board of Managers.}

\textsuperscript{32}\textit{Ibid.}

\textsuperscript{*"July 25, 1913, Miss Eva McNinch tendered her resignation as anaesthetist to take effect Sept. 15, which was accepted with great regret. Filling the vacancy was referred to the Medical Committee."}

\textsuperscript{*August 25, 1913, [the] Medical Committee recommended the appointment of Miss Emma E. Fraser [class of 1908 of the Pennsylvania Hospital Training School], anaesthetist, to take effect Sept. 15, 1913." (Pennsylvania Hospital Minutes of Board of Managers.)}
surgical supervisor with the proposition, but she hesitated to undertake the work without training and, consequently, went to the Mayo Clinic for two months' instruction. She returned to become the first trained nurse anesthetist in the institution, much of her time being spent on the service of the illustrious John B. Deaver (1855-1931).33

The establishment of nurse anesthesia in the major Philadelphia hospitals was practically complete when on January 1, 1915, Alice Weinberg, a graduate of the Jewish Hospital Training School for Nurses, was selected, because of her “pugnacity,” by William H. Teller, to become the first nurse anesthetist in that hospital.34 *

Meanwhile, in New York City, poor anesthesia turned the attention of the chief surgeon at Presbyterian Hospital to a nurse as an anesthetizer. This nurse, who was to play an important role in the anesthesia department not only at the Presbyterian Hospital in New York City but also at the Johns Hopkins Hospital in Baltimore, was Margaret Galt Boise (1883- ). She was a native of New York City, but, at the age of four, she was taken to Berlin where she received her early education. Upon her return to the United States, she entered the Presbyterian Hospital School of Nursing and was graduated in 1907. In 1909, after two years of private nursing in Baltimore, she was called back to the Presbyterian Hospital to be assistant head nurse in the operating room. Her introduction to anesthesia she recounted thus:

Anesthesia at that time was crude and given by the house staff who were not at all interested in the subject. Every patient was strapped down, and a struggle never failed to materialize during induction. The private cases were given by Dr. Bennett or Dr. Creevy using the Bennett machine for gas and ether. Dr. Joseph Blake, then chief surgeon, was dissatisfied with the situation and spotted me as a recruit in anesthesia. He induced Drs. Bennett and Creevy to instruct me but finally decided to send me to the Mayo Clinic for an intensive course under Miss Henderson. . . . I went to Rochester for three months [in 1910] and learned straight ether anesthesia—light stage and without a struggle on the part of the patients who were not restrained. This technique was utterly different from what I had been taught in New York, but Dr. Blake allowed me to do the way I had been taught and appeared pleased. Soon I was giving private cases and took on a pupil,

33 Rapp, Elizabeth: Personal communication.
34 Teller, William H.: Personal communication.
* Teller insisted that the nurse anesthetists should not be under the direction of the chief nurse but of the medical department.
Miss Anne Penland. . . . The Mayo method was used exclusively for children and bad risk cases, but gas induction with the Bennett machine was the usual procedure. . . . During my time in New York . . . positive pressure anesthesia was invented, and Dr. H. H. Janeway had his machine at . . . [Presbyterian Hospital]. I learned its use, but it was too cumbersome ever to be popular. I did not allow patients to be restrained while awake and never allowed a strap to be seen. Cyanosis, even during gas induction, was not permitted. Preliminary hypos were of atropine but no morphine; both of these were drastic changes from what was then taught.35

In 1913 Margaret Boise moved to Baltimore, and, about the same time, Samuel J. Crowe (1883- ) was appointed head of the department of otolaryngology at the Johns Hopkins Hospital. In 1908, when Crowe was graduated from the Johns Hopkins Medical School, interns were giving ether by the cone and struggle method; William Stewart Halsted (1852-1922), the chief surgeon, believed that all interns should learn how to give ether. To Harvey Cushing (1869-1939), with whom Crowe worked in neurosurgery, this kind of anesthesia had nothing to recommend it in operations for brain tumors, and Cushing employed S. Griffith Davis (see Chap. 4, p. 61) to administer anesthesia for him. Private patients paid for this service; for public (charity) patients Cushing paid Davis out of his own pocket. When Crowe was placed in charge of the department of otolaryngology, upon Cushing’s going to Harvard University in 1912, he did not want house officers to administer anesthesia to his patients, nor could he afford to pay Davis, as had Cushing. He found the answer to his problem in Margaret Boise, whom he employed in 1913 as a private anesthetist with the reluctant consent of Halsted. When Hugh H. Young (1870-1945), with whom Crowe shared an operating room on alternate days, saw how well the anesthesia was managed on Crowe’s service, he asked to get in on the deal, and an arrangement was made whereby each would pay half Margaret Boise’s salary. While working for Crowe and Young, she devised a simple machine for the administration of anesthesia to patients undergoing tonsillectomy and, in collaboration with Young, invented a gas-ether machine later known as the Boise-Young apparatus. Halsted could not help but observe how the problems of anesthesia were being handled on the services of Crowe and Young, and when Margaret Boise had been at Hopkins for only

35Boise, Margaret G.: Personal communication.
a few months, he asked to borrow her for the administration of anesthesia for a difficult thyroid operation. The upshot was that she was soon employed by the Johns Hopkins Hospital as the head anesthetist for the surgical department, and she gave anesthetics to most of Halsted's patients until his death in 1922.\textsuperscript{36} (See Fig. 15.)

By 1914 the tide from Rochester, Minn., had begun to turn, and secondary waves of influence carried the practice of employing nurses as anesthetists to new shores. In that year, for example, Gladys Ferrar, a graduate of the Massachusetts General Hospital School of Nursing, was taken from Boston to Barnes Hospital in St. Louis by Fred T. Murphy (1872-1948).\textsuperscript{37} Murphy, the chief surgeon at Barnes, reported on the situation in 1916:

Another graduate nurse, Miss Ferrar, gives, or supervises the giving of, all general anesthetics. This nurse anesthetist received special training as an anesthetist at the Massachusetts General Hospital, and since 1914 has been in charge of this work for the Department of Surgery.\textsuperscript{38}

From that time it was not the example set by the Mayo Clinic but the influence of World War I and of postgraduate schools that accounted for the further extension of nurse anesthesia.

The changes occurring in both the methods of producing and the administrators of anesthesia could not fail to create an active interest among hospital administrators. In 1908, at the convention of the American Hospital Association, delegate John A. Hornsby declared that:

The principles and practice underlying the administration of chloroform and ether are so well understood from the surgeon's standpoint . . . that the interference and interest of the hospital manager are rarely if ever warranted. . . . The remaining anesthetic, recognized generally as such, nitrous oxide . . . is quite another matter, and we can do very much to help the surgeon in its proper and safe administration.\textsuperscript{39}

At the 1911 convention Willis G. Neally, assistant superintendent of the New York Hospital, reported to the delegates on the results of a survey of the prevailing systems of administering anesthesia in

\textsuperscript{36}Crowe, Samuel J.: Personal communication.
\textsuperscript{37}Copher, Glover: Personal communication.
\textsuperscript{38}Report of the Barnes Hospital, St. Louis, 1916, pp. 34-35.
hospitals in the United States and abroad. Fifty-five hospitals in the United States and Canada, 4 hospitals in England, 3 in Germany and 1 in France had responded.

In 25 per cent of the American hospitals nurse anesthetists were employed and received salary and maintenance ranging between $300 and $1,200 a year. In 11 per cent, resident physicians, including two women, were employed at a salary range of $600 to $1,800 a year. In 9 per cent, physician specialists spent a few hours each day at the hospital and received salaries of $600 to $1,000 a year. In another 9 per cent, interns administered the anesthesia to ward patients and were instructed by visiting physician anesthetists who had no salary but received fees from private patients. In 9 per cent, instructors with a salary of $100 to $700 a year spent a few days or weeks in the hospital at the beginning of the interns' service as anesthetists. In 11 per cent, the instructors received no salary.

In the English hospitals some members of the medical staff who were experts in administering anesthesia were appointed honorary anesthetists. Also, there were assistant anesthetists with salaries of $125 to $600 a year and maintenance. The specialists gave the anesthetics in difficult cases and they instructed the interns, who gave most of the anesthetics after they were duly qualified. In Germany the anesthetics were given by the interns, who were licensed physicians. In the one French hospital reporting the interns gave the anesthetics.

In summarizing the situation Neally said:

It will be seen that over 25 per cent of the hospitals heard from in this country employ nurses as anaesthetists. They do not do all the anaesthetizing but instruct the interne and have general supervision of this branch. They take charge of the anaesthetics and supplies, with a marked decrease in the amount used.

In many institutions they assist in the general work of the operating room and take entire charge of the instruments. They do not aspire to be surgeons or assistant surgeons, therefore, they give their undivided attention to administering anaesthetic [sic], consequently many of them became very expert in this line. From practically all of the hospitals come very favorable reports of this system.

Many hospitals were found to be contemplating the employment of nurses for this work.

Where a resident physician is employed as anaesthetist, the interne in the majority of cases gives the anaesthetic under the supervision of
the specialist, the latter giving the anaesthetic in difficult cases. This system was found satisfactory.

In the hospitals employing salaried specialists (physicians) without maintenance, their presence being required but a few hours each day, according to the number of operations, most of the anaesthetizing is done by them. They also instruct the internes who anaesthetize the minor cases and the few occurring during the night.

In the hospitals where the internes give the anaesthetic, without direct supervision, the specialist coming to the hospital for only a few days at the beginning of the interne's service, much dissatisfaction was expressed and quite a few hospitals contemplate employing nurses as anaesthetists.40

Like the woman teacher, the woman nurse anesthetist not only was called into service by desperate need but also brought to her work a natural aptitude that made her superior to the man. Also, like the woman teacher, she had no sooner proved her proficiency, and in many cases her superiority, than efforts were organized to eliminate her (see Chap. 7). Oddly enough, the intern or house officer, whose service as an anesthetist received nothing but condemnation, got by unscathed for reasons that were largely economic in origin.

Running parallel with the wholehearted acceptance of the nurse anesthetist in many quarters and an equally wholehearted antagonism to her in others was the raising of doubts about the legality of her administration of anesthesia. At the same time, the whole question of the proper education of anesthetists, nurses and physicians alike, became a matter of serious concern. While at the beginning of the second decade of the twentieth century the science of anesthesia was still in a rudimentary stage,* the need for proper


*Although, in 1847, John Snow had described five degrees of narcotization (Snow, John: On the Inhalation of the Vapour of Ether in Surgical Operations, London, Churchill, 1847.), not until 1920 were the stages of anesthesia, and particularly the planes of the important surgical stage, clearly elucidated by Arthur Guedel (Guedel, A. E.: Third stage ether anesthesia: a sub-classification regarding the significance of the position and movements of the eyeball, Nat. Anesth. Res. Soc. Bull. May, 1920.). Also, in 1847, Marie-Jean-Pierre Flourens demonstrated the descending paralysis of the nervous system that accompanies anesthesia.

Claude Bernard, one of the first to take an interest in the physiologic action of anesthetics, contended that a reversible coagulation of the cell colloids produces or accompanies narcosis (1875). The lipoid theory of narcosis, advanced subsequently, contended that the action of anesthetic agents was due to their affinity for lipoid substance. The true mechanism of the action of anesthetics remains a mystery to this day.
disciplines and technics in the administration of anesthesia was thoroughly recognized, and the difference between the work of the trained and that of the casual anesthetist was apparent to everyone. In the next three decades, these forces combined to make the history of anesthesia unparalleled in progress and turbulence.

A subject that held the sustained interest of investigators from the beginning was the cause of deaths from anesthetics, particularly chloroform. John Snow contended that deaths during chloroform anesthesia were due to cardiac and not respiratory failure, a theory that, after prolonged controversy, was substantiated by the work of Henry Embley of Melbourne, Australia, in 1902. (Keys, Thomas E.: The History of Surgical Anesthesia, New York, Schuman, 1945, p. 77; Duncum, Barbara M.: The Development of Inhalation Anaesthesia, London, Oxford, 1947, p. 160 ff.; Beecher, Henry K.: The Physiology of Anesthesia, London, Oxford, 1938, p. 30 ff.)