muscular rigidity, lividity, convulsive or suspended respiration, and paralysis. In the slighter cases of poisoning, the symptoms are over in a few hours. Among the antidotes recommended are amyl nitrite, nitroglycerin, ammonia, digitalis, whiskey, atropine, and morphine, but above all it is important to place the patient in a horizontal position, to loosen his clothing, and to perform artificial respiration if necessary. Even though attempts at resuscitation are successful, it is not safe to leave a patient for some time afterward, as a second or third collapse may occur.

Another evil connected with the use of cocaine is the danger that it may lead to the cocaine habit. This danger is most likely to follow the use of cocaine in the nose. On account of its contractile power, the relief which it affords in inflammatory conditions, such as acute coryza or hay fever, is so prompt and delightful that the desire to repeat the application soon becomes very strong. Even more than morphine the drug soon has a terrible grasp upon the unfortunate sufferer, which few men have ever been able to shake off. Many physicians have fallen a prey to cocaine. Under such circumstances a strong word against its careless use is in place here, although the habit has not usually followed its administration for local analgesia.

*Edward Milton Foote.*

**ANÆSTHETICS.**—Agents capable of producing privation of sensation, or anæsthesia (from *a*, privative, and *αισθάνομαι*, I feel), when inhaled or applied locally, have been termed anæsthetics. While the word "anæsthesia" more properly indicates the *condition* of want of sensibility or feeling, it has also been applied and is commonly used to denote the *state* produced by the administration of the general anæsthetics, of which want of feeling is but one of many factors. The word "narcosis" (from *νάρκωσις* or *νάρκη*, numbness or paralysis) is also much employed to signify the *state* of the anæsthetized individual, and will be so used in this article. Agents which act upon the whole organism by their absorption into the blood are called *general* anæsthetics. Those which act only upon the part to which they are applied are called *local* anæsthetics.

Ancient History.—To seek relief from pain is instinctive and the practice of measures for this purpose is undoubtedly of as great antiquity as man's existence. Efforts to obtain freedom from suffering during surgical and other painful procedures are recorded throughout ancient history, and the works of the earliest medical writers contain numerous references to methods in vogue in their times for the mitigation or prevention of pain, through the exhibition of drugs by internal administration, by inhalation, and by local application.

Mandragora, cannabis indica, and opium are the agents that were most commonly used for this purpose, although belladonna, hyoscyamus, hemlock, and others are frequently mentioned in this connection. Mandragora (atropa mandragora) seems to have been the earliest and most favored narcotizing agent of the ancients, and must have been in general use in the times of Dioscorides, Pliny, and Apuleius, for in their writings its action and uses are freely discussed.

Dioscorides mentions three different preparations of mandragora in these terms: 1. "Some persons boil the root in wine down to a third part and preserve the decoction, of which they administer a cyathus [ʒ iss.+] in want of sleep and severe pains of any part, and also before operations with the knife or the actual cautery, that they may not be felt." 2. "A wine is prepared from the bark of the root without boiling, and three pounds of it are put into a cadus [about eighteen gallons] of sweet wine, and three cyathi of this are given to those who require to be cut or cauterized, when, being thrown into a deep sleep, they do not feel any pain." 3. Of another kind of mandragora called "marion" he states: "They relate that a drachm of it being taken as a draught, or eaten in a cake or other food, causes infatuations, and takes away the use of the reason. The person sleeps without sense, in the attitude in which he ate it, for three or four hours afterward. Medical men also use it when they have to resort to cutting or burning."

Pliny, writing of the juice of the leaves of mandragora, states that "it has a soporific power on the faculties of those who drink it; . . . the dose is half a cyathus; . . . some persons even die from a considerable draught; . . . it is taken against serpents, and before cuttings and puncturings, lest they be felt."

Apuleius has written of mandragora: "If any one eat it he will immediately die, unless he be treated with butter and honey and vomit quickly. Further, if any one is to have a limb mutilated, burnt, or sawn, he may drink half an ounce with wine, and whilst he sleeps the member may be cut off without any pain or sense."

Cannabis indica, which is probably the "hasheesh" or "bhang" of the East, the Ma yo of the Chinese, and the "nepenthe" of Homer, was employed by the Scythians, as related by Herodotus, for the production of intoxication. In the East it has long been used for this purpose and for the relief of pain, particularly in the case of criminals about to undergo torture. An example of the use of cannabis indica to prevent the pain of surgery occurs in a biographical sketch of Hoa tho, a Chinese practitioner, of whom it is stated that "if the malady was situated in parts on which the needle, the moxa, or liquid medicines could not act, for example in the bones, in the medulla of the bones, in the stomach, or the intestines, he gave the patient a preparation of hemp, and, at the end of some instants, he became as insensible as if he had been drunk or deprived of life. Then, according to the case, he made openings and incisions, performed amputations, and removed the cause of the malady; he then brought together the tissues with points of suture and applied liniments. After a certain number of days the patient found himself re-established without having experienced the slightest pain during the operation."

Cannabis indica was almost invariably administered by the inhalation of its fumes when burnt, and Pliny, in recording the properties of the juice of mandragora leaves, states: "For these purposes [against serpents and before cuttings and puncturings, lest they be felt] it is sufficient for some persons to have sound sleep from the smell [of the medicine]."

In the thirteenth century Theodoric produced insensibility to the pain of operations by means of narcotic inhalations from a "sleeping ball" or "spongia somnifera," used and described by his teacher, Dominus Hugo of Lucca, and thus made: "Take of opium and the juice of unripe mulberry, of hyoscyamus, of the juice of the hemlock, of the juice of the leaves of the mandragora, of the juice of the woody ivy, of the juice of the forest mulberry, of the seeds of lettuce, of the seed of the burdock which has large round apples, and of the water hemlock, each one ounce; mix the whole of them together in a brazen vessel, and then in it place a new sponge, and let the whole boil as long as the sun lasts on the dog-days until the sponge consumes it all and it is boiled away in it (the sponge). As oft as there shall be need of it, place this sponge in hot water for an hour and let it be applied to the nostrils of him who is to be operated on till he has fallen asleep: and so let the surgery be performed. This being finished, in order to awaken him, apply another sponge, dipped in vinegar, frequently to the nose, or let the juice of the roots of fenugreek be squirted into his nostrils. Presently he awakens."

Although the efficiency of this plan has been doubted, it is recorded that in 1832 M. Dauriol in France, following these directions, operated painlessly in five cases, which he reported. Greek and Roman authors have described the effects of mandrake in preventing the pain of operations, but it seems to have been little used by them on account of its fatal effects; in fact, it is probable that all of the foregoing means of rendering surgery painless were dangerous.

Pliny and Dioscorides describe the local benumbing





effects produced by the application of pulverized marble (memphitis) with vinegar, stating that it will "stupefy parts to be cut or cauterized, for it so paralyzes the part that it feels no pain." Numerous other methods of producing insensibility to the pain of surgical operations are recorded, notably compression of the vessels of the neck as practised by the ancient Assyrians during circumcision, which probably acted by producing the unconsciousness of cerebral anæmia (as also brought about by excessive and rapid venesection for similar purposes); compression of the nerves supplying the part operated upon, as carried out with some success in 1784 by James Moore, an English surgeon. Hypnotism, which "was known to the Indians, Egyptians, and Persians at a very remote period," has been extensively tried as a means of rendering patients insensible to the pain of operations. Cloquet removed a breast painlessly from a hypnotized patient in 1829, and at a later period Esdaile in India performed several hundred operations upon patients, chiefly Hindoos, in the hypnotic state. Elliotson and Braid advocated the method in England, and Liston employed it with some success. Simpson investigated the subject thoroughly and made many very successful experiments with it, but abandoned it as impracticable. The practice of hypnotism for the production of anæsthesia has never come into general use and probably never will, from the fact that only a very small percentage of persons can be satisfactorily put into this state, and in these, repeated attempts are often necessary before a sufficiently deep sleep can be induced so that the subject will be insensible to pain. Furthermore, the condition of the patient during the operation is often far from satisfactory on account of "convulsive movements of the limbs, corrugation of the brows, and even loud cries and sobs," which occur in many cases.

For a long period before the introduction of the anæsthetics of to-day, opium and alcohol were the chief agents employed to lessen operative pain; but the results were far from satisfactory, and M. Velpeau in 1839 wrote: "To escape pain in surgical operations is a chimera which we are not permitted to look for in our day. A cutting instrument and pain, in operative medicine, are two words which never present themselves the one without the other, in the mind of patients, and it is necessary for us as surgeons to admit their association."

Modern History.—The incidents leading up to the discovery of the anæsthetic properties of nitrous oxide, ether, and chloroform, and the introduction of these agents into surgical practice, form one of the most interesting chapters in medical history. In 1799 Humphrey Davy published on account of his extensive researches concerning nitrous oxide, and stated that "as nitrous oxide, in its extensive operation, appears capable of destroying physical pain, it may probably be used with advantage during surgical operations in which no great effusion of blood takes place." Even before this time ether was used by inhalation for the relief of affections of the chest and was known to relieve pain and promote sleep. In 1818 Faraday is said to have pointed out that the inhalation of ether vapor produced effects similar to those of nitrous oxide. The intoxication resulting from the breathing of diluted vapors of these agents became very well known, and was commonly practised as a means of pleasure and amusement. During an exhibition of this kind in Hartford, Conn., on December 10, 1844, Horace Wells, a dentist of that place, took note of the fact that while under the influence of "laughing gas" a Mr. Cooley sustained an injury of the leg without the least evidence of pain. The following day Wells inhaled the gas and had a large molar tooth extracted. As he recovered consciousness he stated that it had not hurt him "more than the prick of a pin," and that it would create "a new era in tooth-pulling," a prediction that has been fully realized, although Wells did not live to see it. After his own experience he immediately tried the gas in his practice with great, though not invariable, success. In a public demonstration of its action at the Harvard Medical School a short time later, the patient—owing no doubt to the imperfect method of administration employed—gave unmistakable signs of pain upon the extraction of a tooth. Wells was hissed and ridiculed by the students present; and although discouraged and believing the gas to be uncertain in its action, he continued to use it in his practice for a number of years.

Wells died in 1848, and nitrous oxide was generally discredited till 1867, when Colton reported twenty thousand successful administrations. After this it rapidly assumed its present status as an anæsthetic. This demonstration of the action of nitrous oxide is not generally looked upon as the discovery of anæsthesia, though in Hartford a monument erected to Wells is thus inscribed:

Horace Wells, who discovered Anæsthesia,
December 10, 1844.

William T. G. Morton, a dentist of Boston and a partner of Wells in 1842–43, devised an improvement in making artificial teeth which necessitated the extraction of all old roots, over which the plates were made and worn at that time. Great difficulty was experienced in inducing patients to submit to this operation on account of the pain, and Morton sought diligently for better methods of preventing it than by the administration of enormous doses of alcohol or opium, commonly used at this time for such purposes. Familiar with the action of nitrous oxide, and knowing the similar effects of ether, he was led to experiment with the latter upon himself and on animals. After succeeding in completely etherizing a dog, he rendered himself unconscious for over seven minutes by inhaling ether from a handkerchief. This occurred on September 30, 1846, and the same evening he administered it to a patient for tooth extraction with perfect success. Within a week he requested Dr. John Collins Warren, a prominent surgeon of Boston, to permit him to administer the agent for him in a surgical operation, and this was done at the Massachusetts General Hospital on October 16, 1846, with such success that Dr. Warren, a very conservative man, exclaimed to the large audience of medical men and students present: "Gentlemen, this is no humbug!"

This was the first public demonstration of the action of ether as an anæsthetic, and although numerous claims of priority have been made, Morton is generally credited with giving the inestimable gift of anæsthesia to the world. The knowledge of this discovery and its use in dentistry and surgery spread with great rapidity. Ether was first administered in England on December 19, 1846; a few days later it was employed in France, and in a remarkably short time its use became almost universal. On January 19, 1847, Simpson first employed ether during labor for forceps delivery, and a few days later to relieve the pain of ordinary labor. He immediately called the attention of the profession to the subject, and notwithstanding widespread and outspoken objections to anæsthetics in these cases, and even in surgery, upon the religious opinion that pain under these circumstances was the will of God and should therefore be borne, their use has become almost a routine practice the world over.

The success of ether as an anæsthetic incited a large amount of experimentation with almost every substance, in the hope of discovering a better agent for this purpose, and on November 4, 1847, the anæsthetic property of chloroform was discovered by Dr. James Y. Simpson, who, with his assistants Dr. George Keith and Dr. Matthews Duncan, inhaled it from tumblers and were all rendered unconscious thereby. On the 10th of the same month Simpson read a paper on chloroform before the Medico-Chirurgical Society of Edinburgh, and on the 15th published a pamphlet on the subject, reporting about fifty successful administrations. The apparent advantages of chloroform over ether caused it largely to replace the latter throughout the world, with the notable exception of the northeastern part of the United States, where faith in ether has never been shaken and chloro-

form, though tried at the time of its discovery as an anæsthetic, was quickly dropped on account of its dangerous action.

On January 28, 1848, less than three months after the introduction of chloroform, a death during its administration occurred, and this was soon followed by reports of others from every quarter of the globe.

From that time to the present, chloroform fatalities have been recorded with great and apparently increasing frequency, while deaths from ether have been comparatively rare. To these facts may be attributed in great part the steady gain of ether throughout the world.

Since the introduction of nitrous oxide, ether, and chloroform as anæsthetics, a large number of similar substances have been found to possess this property, and several of these have been used to some extent. None, however, has stood the test of time as have the three above mentioned, which to-day constitute practically the only agents in general use.

Methylene bichloride, discovered by Regnault in 1840, recommended as an anæsthetic by Sir B. W. Richardson in 1867, and warmly advocated by Sir Spencer Wells, was used very considerably in Europe for a number of years. Its favorable features were, agreeable odor, rapid action, prompt recovery, and freedom from after-effects; but it proved to be unsafe and fell into disuse. It was furthermore found that the substance commonly used as bichloride of methylene was really chloroform diluted with one-fifth of methylic alcohol, and that genuine "methylene" acted as a convulsive poison in the lower animals.

Ethidene dichloride, discovered by Regnault and used to the extent of one thousand eight hundred and seventy-seven administrations by Clover, enjoyed some popularity for a time, but its use never became general. Its action was evidently between that of chloroform and that of ether. Several deaths and accidents are recorded from its use.

Ethyl bromide, discovered by Serullas in 1827, was first used as an anæsthetic by Nunnely in 1849 and was employed to some extent by Turnbull, Chisholm, J. Marion Sims, R. J. Levis, Sir B. W. Richardson, Mr. Clover, J. F. Silk, and others.

It was studied experimentally by Rabuteau, Berger, Wood, Wolff, Lee, Ott, Lyman, and others, and was found, if given freely, to be a powerful circulatory and respiratory depressant. It was very apt to contain bromic impurities and was easily decomposed. Clinically it was found to be an exceedingly rapid anæsthetic, about one minute being sufficient for the production of deep anæsthesia, and, if at once discontinued, Silk demonstrated that an average anæsthesia of 46.2 seconds resulted. Recovery was prompt and very free from after-effects in the short administrations, though headache, faintness, and vomiting often followed its prolonged use. Muscular rigidity was often encountered during its inhalation. It caused "great congestion of the face, neck, and upper part of the chest." The pulse and respiration were usually accelerated. Lachrymation and salivation were often very great; the pupils were usually dilated. Several fatalities resulted from its administration, and although it was used by many with great satisfaction, particularly in momentary or short operations, its present use is not extensive, and it is not generally recommended as an anæsthetic. Fowler has recently commended its use in one or two drachm doses, preliminary to ether.

Ethyl chloride, discovered by Ravelle and studied by Basse, has been successfully employed as an anæsthetic by Heyfelder, Lotheisen, Hacker, Rodier, Weissner, and others. Anæsthesia is induced very rapidly, from half a minute to two minutes being required, according to the individual. If immediately discontinued, anæsthesia lasting from half a minute to three minutes has been obtained, the length of the anæsthesia corresponding to the length of the administration. Recovery has been very free from the usual disturbances. Muscular relaxation is not obtained from this anæsthetic and the patient is apt to regain consciousness during the operation. The administration of ethyl chloride as a general anæsthetic has not been extensive up to the present time, and further researches will be necessary before its true value is determined. As a local anæsthetic its properties are well known. Tuttle has recently recommended its administration preliminary to ether.

Amylene, discovered by Balard in 1844, was carefully studied by Snow in 1856–57. Two deaths occurred under its influence out of the two hundred and thirty-eight cases in which he used it, and it was discarded, although it had been given rather extensively for a while. As an anæsthetic it was not very satisfactory. It did not produce muscular relaxation, but with very light narcosis complete analgesia seemed to be present, and most of Snow's cases were operated upon in this state. The vapor of amylene is not pungent, but has an "offensive, cabbage-like odor." It is no longer used.

Pental is said to be "a pure form of amylene introduced into commerce by Mering." It has been used to a limited extent, particularly for short operations. Its action is similar to that of amylene, though quicker and more constant. Dangerous symptoms and deaths have occurred under it, however, and it is little used at present.

Nitrogen, pure or in combination with small percentages of oxygen, produces unconsciousness which closely resembles the anæsthesia of nitrous oxide. It is not a true anæsthetic, however, its action depending solely upon deprivation of oxygen and consequent asphyxia. Hewitt has employed it in twenty-three cases of tooth extraction, practically pure nitrogen being used in some and in others nitrogen plus oxygen in the proportions of 3, 5, 6.6, 7, and 7.5 per cent. Although anæsthesia was produced in all of the cases, it was not as satisfactory as that of nitrous oxide. The time of administration varied from fifty to ninety-five seconds, according to the amount of oxygen present. The resulting anæsthesia was somewhat shorter than that of nitrous oxide and the after-effects were greater.

A large number of substances similar to those already mentioned have been found to possess anæsthetic properties, but owing to disadvantages, dangers, and the knowledge of better agents, they are not used.

In the hope of favorably modifying the action of the more commonly employed anæsthetics, ether and chloroform, various mixtures of these agents with each other and with other substances have been proposed. The A.C.E. mixture, probably the best known of these, consists of alcohol 1 part, chloroform 2 parts, and ether 3 parts by volume. Martindale states that almost uniform volatilization of this mixture results if the specific gravity of the alcohol is 0.795, the chloroform 1.497, and the ether 0.720. This mixture, originally advocated by Harley, was strongly recommended by the anæsthetic committee of the Royal Medico-Chirurgical Society of London, its action being found by them to be about half way between that of chloroform and ether. This committee also recommended a mixture of chloroform 1 part, ether 2 parts, and another of chloroform 1 part, ether 4 parts, but gave preference to the first or A.C.E. mixture on account of its "uniform blending" and "probably the more equable escape of the constituents in vapor."

Other well-known mixtures are: The Vienna mixture—chloroform 1 part, ether 3 parts: Billroth's mixture—chloroform 3 parts, alcohol 1 part, ether 1 part; Linhart's mixture—chloroform 4 parts, alcohol 1 part; Sansom's mixture—chloroform and alcohol equal parts.

In 1895, Schleich, of Berlin, advanced the theory that an anæsthetic mixture the boiling point of which closely approximated the temperature of the body, would possess great safety and cause the minimum of after-disturbance by reason of the definite and suitable relations thus established between absorption, elimination, and the amount of the agent retained in the circulation. He suggested three different mixtures, as follows:





| | No. 1.—Boils 38° C. (100.4° F.). For light narcosis. | No. 2.—Boils 40° C. (104° F.). For medium narcosis. | No. 3.—Boils 42° C. (107.6° F.). For deep narcosis. |
|---|---|---|---|
| Chloroform | 45 volumes. | 45 volumes. | 30 volumes. |
| Sulphuric ether | 180 " | 150 " | 80 " |
| Petroleum ether | 15 " | 15 " | 15 " |

The petroleum ether used should boil at from 60° to 65° C.

These mixtures enjoyed a brief popularity, and were earnestly recommended in the United States by Maduro, Meyer, and others. Many advantages were at first claimed for this form of anæsthesia—*i.e.*, safety, marked freedom from excitement, cyanosis, flow of mucus, bronchitis, pneumonia, vomiting. Very rapid recovery and slight effects upon the heart, lungs, or kidneys were observed. Clinical evidence, however, soon disproved these claims, and cases of deep cyanosis, alarming states of the respiration and circulation, nearly fatal accidents, excessive vomiting, broncho-pneumonia, albuminuria, etc., occurred with such frequency that a number of those who had at first advocated the method with enthusiasm later published their reversed conclusions.

In 1898 Dr. Willy Meyer brought forward a new mixture "on the basis of the Schleich principle," as follows:

| | | | |
|---|---|---|---|
| Ethyl chloride | | | 17 volumes. |
| "M. S." | Ether, 56.75 volumes | | 83 " |
| | Chloroform, 43.25 " | | |

The mixture of ether and chloroform designated "M. S." is said to be a true molecular solution containing no free ether or chloroform. The boiling point of the total mixture is 40° C. (104° F.). Dr. Meyer considers this single mixture a great improvement on those of Schleich, and in its use he has observed little general disturbance, no struggling, infrequent vomiting, rapid recovery, and no disturbance of the lungs or kidneys.

Many are opposed to the use of anæsthetic mixtures on the ground that their action is indefinite and that, owing to the marked difference in the rate of evaporation of their respective ingredients, the first effect is chiefly due to the more volatile agent, the later effect to the less volatile.

These, and many other theoretical objections to the use of anæsthetic mixtures, are not borne out by practical experience, and they are extensively used and have been given a definite place by most writers on anæsthesia.

Minor and others have demonstrated that the boiling point of a given anæsthetic mixture is not constant on its evaporation. It is probable that the action of such a mixture is that of its most powerful ingredient modified by dilution and by the effect of the other ingredients.

Tyrrell has advocated the administration of mixtures of the *vapors* of ether and chloroform in proportions to suit the effect desired, and has devised an apparatus for this purpose consisting of two Junker bottles, a single bellows, and a mechanism for regulating the proportions of the vapors.

The administration of anæsthetics in succession to one another forms a distinct method of practice, and the plan is attended with numerous advantages. "Gas and ether," which consists in the administration of nitrous oxide before ether, is perhaps the best example of this, and its advantages are as follows: the induction of unconsciousness is almost ideal, being accomplished in from ten to twenty seconds with practically no discomfort, such as attends the breathing of agents which have a strong and more or less pungent odor; complete ether narcosis may be obtained in from two to four minutes from the beginning of the gas, with entire absence of a stage of excitement. Chloroform before ether is frequently resorted to in order that the patient may have the comfort of the more agreeable and less pungent odor of the former and to avoid the mental effect often produced upon the patient by the more formidable-looking apparatus used for the administration of the latter.

In this plan it should not be forgotten that a large percentage of the deaths from chloroform have occurred during the early part of its administration.

Chloroform mixtures before ether are less dangerous and nearly as pleasant. Ethyl bromide and ethyl chloride before ether produce unconsciousness nearly as quickly as gas, but are less pleasant to inhale. The succession of gas, ether, and chloroform is suitable for those cases in which the latter agent is indicated and in which it is desirable to avoid the conditions present during the stage of excitement. The condition of the respiration and circulation under nitrous oxide renders the succession of gas and chloroform a dangerous procedure, and it should not be undertaken.

A change from one anæsthetic to another is often advantageous during an administration. Thus the sedative and depressing effects of chloroform are counteracted by the previous or subsequent administration of ether; and the irritation or excessive stimulation of ether is overcome by changing to chloroform.

A distinct method, often referred to as "mixed anæsthesia," consists in the administration of morphine, alone or with atropine, in conjunction with ether or chloroform. The plan is the outcome, in great part, of the experience of Nussbaum, Bernard, Guyon, Labbe, Kappeler, Julliard, Dartre, and others. The advantages claimed for this method are, that the narcosis is strikingly quiet and smooth, free from excitement, struggling, salivation, and the usual after-effects, and that narcosis is established and maintained by a very small amount of the anæsthetic.

These advantages are undoubtedly pronounced, and the method is employed by many with great satisfaction. Morphine given subcutaneously an hour or two before the operation, so that the full effect is well established by that time, usually renders the patient calm, sleepy, and in an admirable frame of mind for taking the anæsthetic.

Unfortunately, the plan presents certain disadvantages. The action of morphine is greatly intensified in the presence of ether or chloroform, and its excessive action is not infrequently undesirable or dangerous. Alarming respiratory depression and prolonged deep stupor have followed its use, as observed by Dartre, Demarquay, Regnier, Lucas, Hewitt, and others. Regnier and Lucas have witnessed a number of deaths which they attribute to this method, and others have abandoned it on account of these disadvantages. The action of the anæsthetic is also increased in the presence of morphine and an overdose is more easily administered. Regnier asserts that morphine lessens the elimination of chloroform and thus favors its dangerous accumulation in the system. In view of these facts, it is the writer's opinion that this modification of anæsthesia is not suitable as a routine practice, although in selected cases it may often be of great value. Clinical experience has demonstrated that the method is contraindicated in weak subjects, in those presenting respiratory insufficiency, and particularly if dyspnœa from any cause is present; in patients presenting any degree of stupor; in operations likely to be attended by excessive hemorrhage, and in patients who are very susceptible to the action of morphine.

Its application would seem to be particularly advantageous in highly excitable, vigorous, and neurotic individuals, in alcoholics, and in those in whom it would be especially desirable to administer the least possible amount of the anæsthetic, on account of acute or advanced cardiac, pulmonary, or renal disease. It has been recommended for operations about the mouth on account of the slow recovery permitting the removal of the inhaler for prolonged periods. It must be remembered, however, that morphine allays the reflex excitability of the air passages, and that danger of the entrance and toleration of products of the operation or other foreign matter in the lungs is thereby increased. Morphine in doses ranging from gr. $\frac{1}{8}$ to gr. $\frac{1}{4}$ alone, or combined with from gr. $\frac{1}{150}$ to gr. $\frac{1}{100}$ of atropine, are those usually recommended for this purpose. It is obvious that the dose should be chosen to meet the conditions