tumours, which disappear entirely when the patient is made insensible by chloroform.

Chloroform inhalation gives relief in neuralgia, sciatica, colic of the intestines, if the pain is very severe, in distressing dyspnœa, whether this is due to asthma,* aneurisms, &c. In asthma the inhalation of a few whiffs without producing unconsciousness sometimes affords permanent relief; and if the paroxysm returns on the effect of the chloroform passing away then the inhalation may be repeated. A small quantity of chloroform given in this way often suffices to prevent an attack, though in most cases the effects are only transient, the paroxysm returning as the influence of the drug wears off.

It is said insomnia, tremulousness and inability to fix the attention are apt to follow the repeated use of chloroform inhalation.

ETHER.

The physiological action and therapeutic use of ether and chloroform are for the most part identical.

As a local anæsthetic in neuralgia, toothache, etc., ether is less frequently used than chloroform.

In the form of spray, after the method introduced by Dr. Richardson, ether is commonly employed to abolish temporarily sensation of the skin; the rapid evaporation of the ether and consequent great abstraction of heat, freeze the tissues and deprive them of sensation. Ether spray is frequently used in minor operations, as the opening of abscesses, the removal of small tumours, etc. It has been successfully em-

* Mr. Gaskoin reports a case of bronchitic asthma much benefited by rubbing the chest for an hour daily with liniment of chloroform. He attributes the success to the friction, and refers to a Widow Pau who has obtained a reputation in Paris and who uses friction in cases of asthma.

ployed in amputation of the leg and in ovariotomy, but it is not generally available in such serious and prolonged operations. The skin or mucous membrane, when sufficiently frozen to permit of an operation without pain, becomes pale, shrunken, tallowy-looking, and feels as if oppressed with a great weight. Whilst recovering the natural condition, the frozen tissues tingle and smart, sometimes so intensely as to exceed the pain of the operation. The obvious advantage of ether spray over chloroform inhalation is its perfect safety.

Ether for many years preceded chloroform as a general anæsthetic; and although at the present time chloroform has almost completely superseded ether, yet each has its respective advantages. Ether differs from chloroform in several particulars. Ether must be inhaled in larger quantities, and for a longer time; its effects pass off sooner, consciousness often returning almost immediately the inhalation is suspended; and it produces much more excitement than chloroform. The committee of the Medical and Chirurgical Society instituted to investigate the action of chloroform and ether, state that at first both strengthen the heart's contractions; soon, however, the heart grows weaker and weaker as the animal passes more deeply under the influence of chloroform; while the tonic effects of ether persist, and the heart's pulsations often continue strong till the moment of death, which in almost every instance depends on paralysis of the muscles of respiration. Thus ether and chloroform each destroy life by arresting respiration; but in regard to chloroform there is an additional danger from its depressing action on the heart.

In America ether is used in preference to chloroform. Mr. C. Tomes writing from America to the British Medical Journal, says, that ether is there considered so safe that the pulse is rarely watched and the patients when fully under the influence are put into any position without fear of danger. The ether is very freely used, sometimes half a pound is consumed for a single operation. He says "two or three ounces of pure anhydrous ether are poured upon a conical

sponge previously moistened with water, and this is placed over the patient's mouth and nose. Ether is lavishly poured upon the sponge so that it often runs down the patient's face and neck. Sometimes it excites a good deal of spasm of the expiratory muscles, stridulous breathing and laryngeal spasm, and sometimes a degree of asphyxia far transcending that which I have seen during the administration of nitrous oxide, but no anxiety is felt, the sponge is merely removed for half a minute. It is not a pleasant anæsthetic, patients are apt to be noisy on recovery; vomiting during and after the administration is common." Equally strong testimony regarding the comparative safety of ether is given by numerous authorities in this country, so that it is surprising that it is not more generally used. As ether is highly inflammable Mr. Hutchinson cautions against using it by gas or candle light or when employing actual cautery.

Full doses of ether or spirits of chloroform often act as soporifics and are very useful in angina pectoris, sometimes even giving more prompt and permanent relief than nitrite of amyl.

Freezing the skin with ether spray sometimes permanently removes sciatica or neuralgia, but generally the relief is only temporary.*

* In an interesting lecture on anæsthetics, Dr. Richardson discussed the merits of the following substances, differing only in the amount of chlorine they contain.

C	H	H	H	Cl	Chloride of methyl.
C	H	H	Cl	Cl	Bichloride of methyline.
C	H	Cl	Cl	Cl	Chloroform.
C	Cl	Cl	Cl	Cl	Tetrachloride of carbon.

"All these substances," he says, "possess the power of producing anæsthesia when they are inhaled as vapour by men and animals.

"Chloride of methyl exists in all ordinary temperatures as a permanent gas. It is very soluble in ether; and when ether is saturated with it, the compound is one of the most perfect of anæsthetics. Unfortunately this compound is not very stable, the sleep produced by it is rapid, gentle, profound and prolonged, and I found in an animal, where I may say I forced the animal to die by increasing the quantity of the vapour, that the muscular irritability was perfect one hour and five minutes after death." It is soluble in water, and water charged with it will take up four volumes. Chlormethyl water is rather agreeable to drink, and is a potent intoxicator. Half an ounce has a very decided but transient effect.

"Bichloride of methyline is a colourless fluid, having an odour much like the odour of chloroform. It is pleasant to inhale as vapour, and produces very little irritation of the fauces and air passages. Its specific gravity is 1·344. From its position physically it combines many of the properties of chloroform with those of ether, and these peculiarlties must be remembered in its administration. From its easier evaporation it requires more free administration than chloroform, and from its greater density of vapour it requires less in quantity than ether." The bichloride of methyline sometimes excites vomiting. Dr. Richardson, to whom we are indebted for the introduction of this anæsthetic, thinks it less dangerous than chloroform. In an interesting letter to *The Lancet*, Mr. T. C. Morgan says that bichloride of methyline has many advantages over chloroform; for, 1st, it is safer; 2nd, its action is more rapid, complete unconsciousness being usually induced in two minutes; 3rd, recovery is more prompt, the patient regaining complete consciousness in one to three minutes; 4th, dangerous symptoms subside sooner, lividity disappearing in a few seconds on discontinuing the inhalation; 5th, if during the operation consciousness returns, it may be abolished by a few inspirations. Mr. Morgan thinks it excites vomiting about as often as chloroform.

IODOFORM.

Iodoform is a healing and easing application to spreading

He has administered it over 1800 times to persons of all ages and has sometimes continued the inhalation for three-quarters of an hour, but never lost a patient. He employs "a perforated card-board frame, covered with flannel, and fitted with lappets to lie over the face so as to completely exclude air. Two drachms are put into the inhaler, and it is so closely held before the face as to allow no air to be breathed except what passes through the flannel. In less than two minutes the patient is usually completely insensible. Another drachm is then put into the inhaler, and given as required." He does not care to watch the pulse though this is sometimes much retarded, sometimes beating only twelve strokes per minute without any alarming symptoms. He watches the lips and breathing, when the lips become white and bloodless he stops the administration, fearing pallor, not lividity, for patients die from syncope, not coma.

Mr. F. Searle's testimony is similar, but he states that it rarely excites vomiting, and that it is important not to allow the patient to recover before the administration is completed, otherwise excitement ensues. Mr. Miall and Mr. Gaine also speak highly of this anæsthetic.

and sloughing sores, as bed sores and soft chancres. The sore dusted over with iodoform is covered with some bland application, as glycerine spread on lint. Iodoform has been successfully employed in ulceration of the nose and throat. It relieves the pain of cancerous sores. When employed in uterine cancer, a bolus containing eight to sixteen grains made up with cocoa-nut fat is inserted into an excavation produced by sloughing or ulceration. An iodoform suppository is also useful in painful diseases of the rectum and bladder.

Dr. Tanturri recommends an Iodoform ointment of (3j to 5j) for Prurigo.

Iodoform is said to relieve the pain of neuralgia and gout. A saturated solution of iodoform in chloroform is advised in neuralgia.

Iodoform must not be applied to inflamed tissues, or it will increase the inflammation.

Given internally, it produces a kind of intoxication, followed by convulsions with tetanic spasms, and the breath and tissues of the animal smell of iodoform.

HYDRATE OF CHLORAL.

We owe most of our knowledge of this valuable medicine to Liebreich, whose experiments and conclusions Dr. Richardson has in the main confirmed.

Chlorine acting on alcohol ($C_2 H_6 O$) first produces aldehyde ($C_2 H_4 O$), and afterwards chloral ($C_2 H Cl_3 O$), which forms a crystalline soluble hydrate.

Liebreich believes that the alkali of the blood decomposes hydrate of chloral, forming chloroform, and that the properties of chloral are due to the chloroform slowly formed in the blood. Dr. Amory concludes from his experiments that

chloral hydrate does not decompose in the blood, and that its effects are consequently not due to chloroform. He could not detect chloroform in the blood and excreta, (breath &c.,) of animals poisoned with chloral; whilst in animals poisoned with chloroform this substance was easily detected in the blood and excreta.

The following are Liebreich's conclusions concerning the effects of chloral:—

1. "That chloral in efficient doses quickly produces deep sleep; and when carried far enough. complete anæsthesia.
2. "That the action is without excitement.
3. "That the agent leaves no bad after-effects.
4. "That the nervous power of the heart is the last that suffers."

Liebreich, Tay, Hammond, and others find that hydrate of chloral depresses the temperature sometimes to the extent of three or four degrees after a full dose of 40 to 80 grains.

Dr. Levenstein reports the extraordinary case of a man aged 35 who was poisoned by six drachms of hydrate of chloral. When first seen the man lay in a profound sleep with congested face, heavy breathing, and a pulse of 100. An hour after the poisoning he became livid, the veins were distended, the respirations were intermittent, and his temperature was 103° Fah. An hour and half after the dose he became pale, pulseless with contracted pupils, and his temperature had sunk to 91·2. Nitrate of strychnia enough to produce twitching was then injected hypodermically and the heart at once began again to beat, and the thermometer marked 91·9° Fah, Collapse, however, returned in a few minutes, the circulation appearing to stop. Artificial respiration was performed and nitrate of strychnia again injected with the same result as the first injection. In ten hours the pupils acted to light; in twelve the temperature was 100·4; in twenty-two hours he could be roused, and after thirty-two hours he awoke "quite refreshed" and did not complain of any gastric disturbance. Dr. Fothergill in his important

lectures *on the Depressants of the Circulation* says that Dr. Lauder Brunton finds that after large doses of chloral the temperature falls till it can no longer be measured by an ordinary clinical thermometer. Having determined what dose would kill an animal when exposed to the air, he gave this quantity to two similar animals, wrapping one in cotton wool. The one wrapped up survived, the other died. Then he found out the fatal dose to an animal wrapped up in cotton wool, and gave that quantity to two similar animals wrapping up one in wool and putting the other in a warm chamber; and he found that the one in wool died, the other recovered. A still larger dose was fatal to the animal in the warm chamber. These experiments show that the loss of heat is one, but not the sole, cause of death.

Dr. W. A. Hammond's observations throw some light on the way hydrate of chloral produces sleep. At first chloral congests the retina, but in five or ten minutes the opposite condition commences, and increases till the retina assumes a pale pink colour. As the retinal circulation corresponds with the cerebral, he concludes that chloral affects the brain in the same way as the retina, and has proved the correctness of this inference by means of an instrument called the cephalohæmometer, invented independently by himself and by Dr. Weir Mitchel. Dr. Hammond says that while the brain is congested there is some mental excitement; but as the vessels contract, drowsiness supervenes; and on this wearing off, the retinal and cerebral vessels enlarge till they assume their accustomed size. In his lectures on vascular depressants Dr. Fothergill ascribes this anæmia of the brain to the effect of chloral on the general vascular system. He refers to Ludwig's and Scheff's experiments showing that in health the arterial system is constantly in a state of semi-contraction and that by relaxation of the vessels the capacity of the vascular system may be doubled. Dr. Fothergill points out that chloral dilates the arterioles especially of the skin; hence blood is withdrawn from other organs and from the brain which thus becomes comparatively anæmic. In common with

most other authorities he believes that the anæmic state of the brain is one condition favouring sleep, but that chloral like other narcotics in producing sleep, acts besides in other, but as yet unexplained ways.

Liebreich asserts that strychnia is an antidote to chloral.

Hydrate of chloral is employed to produce sleep or allay pain. Chloral sleep is generally calm, refreshing, and dreamless, not too profound to prevent waking to cough, take food, etc. As a general rule, chloral causes no giddiness, headache, nervous depression, constipation, sickness, or loss of appetite. A patient roused from chloral sleep will eat a hearty meal, then lie down and immediately fall sleep again.

Chloral at first sometimes causes a good deal of heaviness and sleepiness on the following day, but this effect soon wears off. It occasionally produces frightful dreams, and sometimes much excitement, intoxication, and even delirium without sleep.*

* Dr. Reynolds narrates the following case. Similar effects have been witnessed by others. "After a dose of fifty grains, in the course of an hour some 'faintness' was felt; and when I saw the patient this had increased to an alarming degree. Two hours had passed since the medicine was taken, and I found the patient with cold extremities; an excessively rapid, weak, irregular, and intermittent pulse; jactitation of limbs; an intolerable sense of sinking, and oppression at the pit of the stomach; gasping breathing, and confusion of thought.

"I observed at this time, and for three-quarters of an hour subsequently, that the radial, temporal, and tibial pulses were all of the character I now describe—frequent, weak, irregular, in both force and rhythm, and frequently intermittent—but that the heart was acting regularly, although with increased frequency and diminished force.

"Stimulants, with white of egg, were administered freely, warmth was applied to the extremities, sinapisms were put on the cardiac region, fresh air was introduced plentifully into the room, and at the end of an hour from my first seeing the patient the pulse had become much steadier, though still very frequent and very weak. The syncopal feeling had diminished, the feet were warm and there was a tendency to sleep.

"This state of comparative freedom from urgently dangerous symptoms lasted for longer than an hour, when, without any apparent cause, they returned with increased severity. The patient now seemed in the gravest

Sleep comes on sometimes in a few minutes, but more commonly half an hour, after a dose of chloral. Like other soporifics, it should be given shortly before bed-time, and the patient should avoid excitement, and keep quite quiet, or the medicine, instead of sleep will produce restlessness. It has been given for months without any bad results. Sometimes its effects wear off, but in a far less degree than is the case with opium.

Chloral has been found useful in a variety of circumstances. It subdues the sleeplessness of old people, and the wakefulness induced by excessive mental fatigue, succeeding where opium, bromide of potassium, and other remedies have failed. In delirium tremens it produces sleep, and calms delirium; but is especially successful when administered at the onset of the symptoms, often averting a serious illness. Large doses have been given, even sixty grains or more, repeated several times. Dr. Da Costa cautions against its administration to patients with a weak heart. He advises its combination with opium. In paralysis of the insane, full doses induce sleep at night, and a moderate dose calms excitement by day. Dr. Macleod avers that it is superior to digitalis or the hypodermic injection of morphia. He has given it daily to the same patient, without bad effects, for upwards of three months. Luke, Clouston, Gardiner Hill, G. Crawford, recommend it in acute mania.

It is employed in puerperal mania and in puerperal con-

danger. The superficial pulses were almost imperceptible; and when they could be detected, presented the character I have described. Still the heart was regular in its beat, although feeble and intensely rapid in its pulsations. The mind wandered much; there was utter prostration of muscular strength, the limbs being extended, the head low, and the aspect was at times that of impending dissolution. There was great dyspnœa, a sense of suffocating oppression at the base of the chest (in front), and urgent thirst.

"The treatment previously adopted was again pushed vigorously, and at the end of an hour and a half relief was obtained, and sleep followed. The next morning I found the pulse quite regular, and of its normal frequency."

vulsions, (Hay, Adams, Teller.) It is conveniently administered to the insane in porter.

Dr. James B. Russell, of Glasgow, recommends it in typhus, to produce sleep and allay excitement. He finds it most useful in violent boisterous delirium. Dr. Russell much prefers it to opium, as the patient can be roused to take food, and readily wakes to clear the bronchial tubes, hence there is much less danger of congestion of the lungs. He states that it is a much more certain hypnotic than bromide of potassium.

Dr. Hughes Bennett finds it useful in phthisis, stating that it produces sleep, allays cough, and sometimes checks sweating, without producing any of the harmful effects of opium.

Chloral sometimes restrains the involuntary movements of chorea, but in many cases it is powerless in this respect. It is most useful in those cases where the violent movements render sleep impracticable, the want of sleep in its turn aggravating the choreic movements, till even deglutition may become almost impossible. In these urgent cases ordinary remedies like arsenic are useless, and recourse must be had to narcotics. Large doses of chloral, frequently repeated, will often produce profound refreshing sleep, from which the patient wakes calmed and less convulsed. (*vide* Chloroform).

E. Lambert recommends chloral in parturition in fifteen grain doses every quarter of an hour till the patient falls asleep; and he states that this treatment does not weaken the uterine contractions, while it prevents pain, and insures calm repose after delivery. Dr. Playfair thinks that chloral acts far better than chloroform inhalation, as chloral does not lessen the strength of the contraction whilst it greatly lessens the suffering. Moreover, it is chiefly applicable at a period when chloroform "cannot be used, that is towards the termination of the first stage, before the complete dilatation of the os." The patient falls into a drowsy state—a sort of semi-sleep. Dr. Playfair gives fifteen grains, and repeats the dose in about twenty minutes, leaving its subsequent administration to circumstances.

Chloral is often useful in the convulsions of children. Given in a dose sufficient to induce sound sleep of some hours, the convulsions cease, and often do not recur when the child wakes. If the child cannot swallow, five grains given by the rectum soon makes the child fall into a deep sleep, and the convulsions then cease, at least temporarily.

Five grains of chloral given twice or thrice daily will often remove a common condition characterized by restlessness, irritability, and nervousness.

Dr. Bradbury and Dr. Thompson speak very highly of the efficacy of chloral in nocturnal incontinence of children.

Liebreich recommends chloral in sea-sickness.

The shortness of breath affecting the emphysematous on catching cold often yields to chloral. When the dyspnœa occurs at night, a full dose (twenty-five to thirty grains) at bedtime calms the breathing, and gives sound refreshing sleep. When the difficulty of breathing is continuous, small doses (two to six grains) should be given several times daily.

It is necessary to give chloral with caution to patients with emphysema and bronchitis accompanied with obstructed circulation, causing lividity and dropsy; for an ordinary dose, besides drowsiness, may produce muttering delirium and a notable increase in the lividity; these effects often lasting several days, and attributable possibly to the slow destruction of the drug in the blood. These effects are not owing to any peculiarity on the part of the patient, as the author has seen chloral produce these symptoms in a patient who had previously taken the medicine with benefit.

A full dose of chloral is often useful in a paroxysm of asthma.

Some cases of tetanus have apparently yielded to chloral in large doses; and in some instances this drug has prolonged life and eased pain.

The statements concerning the influence of chloral on pain are conflicting, some asserting that it produces anæsthesia, while Demarquay states that in many instances it excites hyperæsthesia. Chloral it is said simply makes a patient

oblivious of pain; but if the pain is too urgent to permit of sleep, chloral fails to give relief. This metaphysical explanation is certainly incorrect; the truth being that for some unexplained reason, chloral in certain cases subdues pain, while in other instances, apparently similar, it fails. Chloral sometimes relieves the pain of neuralgia, chronic rheumatism, gall stones, colic, gastralgia. In doses of ten grains, three times a day, it has relieved most severe pain of cancer, without inducing drowsiness. Injected hypodermically, it is liable like chloroform to excite inflammation, and to produce an abscess followed by a scar.

The addition of a small quantity of morphia considerably intensifies the narcotic effects of chloral.

When equal parts of chloral and powdered camphor are rubbed together, they form a syrupy liquid, which, painted on the painful part or gently rubbed in, often affords relief in neuralgia. My friend, Dr. George Bird, has used this compound in several cases of neuralgia and pleurodynia with great success. I have known it cure, promptly, neuralgia of the inferior dental branch of the fifth and neuralgia in the temporal region. It is said often to relieve toothache even when applied externally. I have known it succeed when introduced into the cavity of the carious aching tooth, but like other applications for neuralgia it often fails without apparent cause, in cases very similar to those it had benefited. When successful it generally affords almost instantaneous relief. I have known it afford relief in severe pleurodynia.

Valuable as chloral undoubtedly is, it has scarcely sustained its early reputation. It is not so certain a hypnotic as the first overdrawn accounts of its virtues led us to believe. Not unfrequently it produces great excitement, even intoxication, without inducing sleep. Sometimes we meet with a patient who has hitherto taken chloral with good effect, yet, on the occurrence of an acute illness, not only has this drug failed to induce sleep, but, on the other hand, has induced restlessness, even delirious, with a parched dry skin. Yet with all its drawbacks it is a most valuable remedy.