ANÆSTHESIA.

Campbell

CDCCCLV
"Anaesthesia", although the usual, is certainly not the best name for the state induced by ether and chloroform, in which voluntary motion, and, as far as we have evidence, thought too, are quite as much suspended as the other great function connected with the brain—sensation, and which in short is neither more nor less than coma.

In coma, "a gradual suspension takes place of the whole cerebral functions, beginning with the intellectual and moral, afterwards involving the instinctive and automatic acts, and finally the unconscious reflex phenomena"; in anaesthesia too, the intellectual functions are first
affected, while "The ganglionic system is the last of the sequence to become involved, and the contractions of the heart the last of the vital actions to become arrested." "The word coma has been objected to by some, although according to our present ideas, it would be difficult to separate the state induced by chloroform from that of coma. Assuredly a condition such as has been described, in which the strongest stimuli and even cutting fail to rouse the patient, and where stertorous breathing is present, can receive no other name"... It is questionable therefore whether chloroform or ether should be denominated anaesthetic agents, because anaesthesia is
generally understood to mean loss of sensibility in a part; whereas, in point of fact, it is suspension of the faculties of mind, and unconsciousness of external stimuli that they produce. There is the same complete insensibility and relaxation, the same stertorous breathing, the same dilated pupil, the same generally steady pulse becoming weak and intermittting only when either state is approaching its fatal climax, and the same occasional evacuation of the stomach, rectum and bladder. Any surgeon, never having heard of such a thing as artificial anaesthesia, and coming into an operating theatre where a patient was lying under the influence of chloroform, would certainly suppose that he was about to be trephined for some meningeal clot or abscess.
In the artificial induction of anæsthesia, as in all things else, we find the Chinese laying claim to a superlative antiquity; for it is said, that so early as before the middle of the third century, a physician Ho-a-tho, when about to perform certain painful operations, gave the patient a preparation of hemp, and that at the end of a few moments he became "as insensible as if he had been drunk or deprived of life." The Greeks and Romans seem to have used "mephis stone," if not with the same asserted success, at least for the same purpose; and, in the thirteenth century, it was the practice of Hugo of Lucca to hold sponges dipped in various vegetable juices under the noses of patients, which "made them sleep during operations." In 1784 it was proposed by Dr. Moore to compress
The principal nerves supplying the parts to be operated upon, a device previously hinted at by Ambrose Parè. More recently, ligation of the larger vessels of the neck was suggested, and their compression was mentioned by Hoffman, Valvardi and Morgagni. In 1821 a gaseous substance which its advocate did not choose to name was announced as rendering patients insensible; in 1828 the inhalation of a gas, probably carbonic acid, was tried by Hickman; and in 1842 was nitrous oxide used in Hartford, for doing away with the pain of extracting teeth. But none of these means seem to have been so effectual as to come into general use, and it was not till 1846 that the induction of Anaesthesia came to be a common occurrence.
in the practice of surgery. In that year, Dr. Morton introduced ether as an anaesthetic, in America. Mr. Horace Wells asserts that it was from him that Dr. Morton got the idea, and that by the help of ether he had performed painless operations two years before, and he supports his claim of priority by the signatures of witnesses, countersignatures and seals. But there were others who could bring forward the same sort of evidence, for eleven practitioners of the city of Boston write thus, "We have diligently sought for the facts in relation to the authorship of this discovery, and from the direct information which we have been able to obtain, we are satisfied that society is indebted for it, be it
more or less valuable, solely to our very worthy fellow citizen and professional brother Dr. W. T. Jackson. Dr. Robert Collyer too reminded the profession that in 1842 he had made a great many successful experiments, in which "the unconscious condition was never less than half an hour and sometimes much more", and that in 1843 he had published a work on the subject. The effects of this substance in lessening pain had been noticed long before, but only in 1846 were they brought prominently forward, as available in operative surgery, and that by Dr. Morton. In this country, it was first tried in London, by Mr. Liston, in amputation of the thigh.
ments of any magnitude, it had to go through the ordeal of an ultimately confirming opposition. One of the first started objections was that the very aim and object of the thing was bad; no sooner was the means of annihilating pain found out than it was also found out that pain was not so bad a thing after all as everybody had hitherto supposed. One lecturer, in speaking of the employment of ether during the application of the cauterery, went the length of saying "They seek to prevent pain, and it is precisely pain which is necessary in these cases," an assertion premature at least, when painless cauterization had scarcely yet been tried. And, in remarking on a case of lithotomy, in which, although ether had been employed and the patient had died, the ether had not been altogether convicted of the death
which happened some twenty-four hours after the operation, a hospital surgeon in the south of England gave it as his opinion that "pain is doubtless our great safeguard under ordinary circumstances, but for it we should be hourly falling into danger, and I am inclined to believe that pain should be considered as a healthy indication, and an essential concomitant with surgical operations, and that it is amply compensated by the effects it produces on the system as the natural incentive to reparative reaction." At a meeting of the South London Medical Society, three questions were proposed regarding etherization, and two of them were somewhat fundamental—first, whether or not it was useful to abolish pain during a surgical operation—and secondly, whether this could be safely done by ether. As for the first, it needed no lengthy
ended argument to satisfy the inflexions, and certainly none to convince the sufficiency of the pain of operations, that the removal thereof was in itself "useful."

The second query was most distinctly answered in the affirmative, a short time afterwards, in some tables compiled by Dr. Simpson, of which the following is an extract:

<table>
<thead>
<tr>
<th>Reporter</th>
<th>Operation of thigh (g. cm)</th>
<th>of thigh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malgaigne (Paris)</td>
<td>57</td>
<td>62</td>
</tr>
<tr>
<td>Peacock (Edinburgh)</td>
<td>...</td>
<td>4.9</td>
</tr>
<tr>
<td>Lawrie (Glasgow)</td>
<td>40</td>
<td>3.6</td>
</tr>
<tr>
<td>Phillips (Gen. Col.)</td>
<td>35</td>
<td>4.4</td>
</tr>
<tr>
<td>Simpson (Britain)</td>
<td>29</td>
<td>3.8</td>
</tr>
<tr>
<td>Etherised</td>
<td>23</td>
<td>2.5</td>
</tr>
</tbody>
</table>

It was only by statistics that the matter could be fairly decided, and this table shows that the pain may
be abolished not only safely but advantageously.
The abrogation of consciousness was advanced as an objection to the new practice of etherization, and there have occurred cases in which it has been taken advantage of for the commission of crime; but the good rule of having plenty of assistants present (though followed for a different purpose) will effectually prevent any such disaster. In short, so great was the desideratum of painless operations and so unfailingly the operations with ether painless, that nothing — neither the report of its having brought on in a healthy subject an epileptiform fit — an order of the concil of health of Zurich, prohibiting, in consequence of certain accidents, its use
in minor operations—a similar order by the
Grand Duke of Hesse Darmstadt—its adminis-
tration being patented for England and the colonies
—nor even the occurrence of a few fatal cases
proved any considerable hindrance to its uni-
versal adoption. But satisfactory as ether had
been found it was not long of being superseded;
for, in the end of 1847, Dr. Simpson, in the course
of some experiments in search of anaesthetics,
made a trial of chloroform; and “only one week af-
ter the publication of Dr. Simpso's pamphlet on
the subject, it was universally employed in the Parisi-
an hospitals and recognised as superior to ether.”
Dr. Flourens had recognised its effects on animals, and in 1842 Dr. Gowers of Newcastle had published some experiments with several anaesthe-
tic substances, and among them chloroform, which he took as a type of the whole; yet it was left for Dr. Simpson five years afterwards to put its properties to some practical use. Mr. D. Waldie of Liverpool has put in a claim to a share in the discovery of this application of chloroform; but altogether it amounts to no more than this, that he had in conversation recom-
mended Dr. Simpson to "try it," promising to pre-
pare some after my (Mr. Waldie's) return to Liver-
pool, and send it to him." Just as it was Dr. Morton's experiment, with no witness but his watch, that led to the introduction of ether, so it was Dr. Simpson's experiment, on the 14th of November 1847, that led to the introduction of chloroform. An attempt has recently been made to obtain the anaesthetic effect, without incurring the risk attendant on powerful narcotics, by the local application of cold, a practice recommended by Dr. Arnot, and at present being somewhat extensively tried.

The uses of anaesthesia may be divided into those that are palliative and those more
directly curative. The former are by far the most important and reliable, and it is mainly by them that it has so largely curtailed the application of the aphorism "dolor medicina doloris." It is not merely actual pain that is escaped, but those multipliers of pain, its expectation and recollection. Many a patient evidently suffers far more from the shadow that a little operation casts before it than from its actual performance, asking eagerly whether it will last long and fearing that he will not be able to stand it. "In disease, the sternest minds and the most possessed have looked death steadily in the face, day by day, week by week, and month by month; they have reasoned calmly of that which they believed to be surely carrying them onwards to their grave; and yet
They have recoiled, trembling and appalled, from the thought of an operation which a turn of their malady may have rendered expedient or imperative.

Not the least of the uses of anaesthesia is that by annihilating these forebodings it allows operations to be resorted to at an earlier and therefore in all likelihood a more safe and successful period — before dissection has become hazardous by encroachment of the tumour upon bloodvessels or serous sacs — before the lymphatics have declared that the cancerous matter is beyond the reach of knife and caustic — before the limb unfit for working good has had working mischief. Blood is economized; for, not only is leisure afforded for dealing with comparatively small vessels, which
The surgeon might have been chain of touching in a patient wincing from every catch of the forceps; but venous haemorrhage is now no more increased by the patient's struggles, like a jet at the bend of the elbow by the closing of his fist; and moreover a tour-miquet, whether of thumbs or of buckle and screw, is a vast deal more reliable on a passive than on an obstreperous limb. Anaesthetics have been found most efficacious in various spasmodic diseases: as in a case of hydrophobia in the Mauritians, "always with the effect of temporarily alleviating the symptoms," also to arrest the paroxysms of hooping cough, dysmenorrhoea, colic, and the pains attendant on the passage of biliary calculi; and in neuralgia they have stopped the fit at once. Dr. Todd's experiments point to the use of such remedies in some kinds of poisoning.
He administered ether to animals in which the tetanoid state had been excited by strychnine—"the spasms ceased immediately, and the animal became perfectly relaxed; but as soon as the effects of the ether passed off, the spasms came on again, but were soon subdued by a fresh inhalation of ether." Its palliative uses must generally be indirectly curative, but there are others curative in their immediate aim. For instance—a joint surrounded by powerful muscles has been dislocated, and the period of prostration has gone by, or the ends of a fractured bone are obstinately overlapping, or a hernia refuses to return to its proper place—in such cases the grand desideratum is relaxation, and the surest way of effecting the same is to have the patient thoroughly
narcotised. In a case in the Edinburgh hospital, simulating urethral stricture, chloroform was used at the patient's request, with a purely palliative intention, but more than a palliative result; for at the first attempt during its influence, the bougie passed into the bladder unopposed. I believe that one of our nobility, by being anaesthetised for sometime continuously, had his life saved from an attack of the epilepsy he inherited along with his rank; and in the only similar case in which I have seen the same means employed, a case of epileptic convulsions during labour, the intervals between the fits, which had been pretty regularly a quarter of an hour, was upon the inhalation of chloroform, immediately lengthened to three
quarters, and the paroxysms when they did occur considerably modified. In delirium tremens, chloroform has produced sleep ten hours after the vain exhibition of half an ounce of laudanum. Even in cases where anaesthetics are of no direct or immediate use to the patient, they are sometimes a great assistance to the practitioner, as in removing a furious lunatic to a place of confinement, in facilitating on an emergency during an operation the discussion of matters not so freely to be spoken of in the patient's hearing, and in detecting malingerers. The use of anaesthetics about which there has been most discussion is their
application to midwifery. Both medical and non-medical objections have been urged. Thus it has been argued that, because the pain of labour is the fulfilment of a divine curse and prophecy, it ought not to be interfered with; though of those who, on this ground, refuse to let their patients bring forth children except "in sorrow," probably none refuse also, for the sake of consistency, to eat their bread except "in the sweat their brow."

It has also been objected that anaesthesia in midwifery is unnecessary, and that births went on well enough before its introduction; but if every improvement must be shown to be necessary before it is adopted,
the progress of all improvement will be very much retarded; dissections and trephinations were successfully conducted without anaesthetics just as labours were, yet nobody maintains that in such cases the anaesthetics should be unemployed because unnecessary; the older physicians managed to diagnose pneumonia and pericarditis without auscultation, jaundice and the mulberry calculus without the microscope, nevertheless in these instances, the stethoscope and the microscope although unnecessary were not unwelcome. Another objection offered is that the practice is unnatural; now, what is here meant by unnatural? If it mean contrary to-
-nature, then the practice, so far from being unnatural, is but the result and expression of one of the most invariable and universal elements of human nature, the impulse to escape from pain; if however it mean superadded to nature the objection is at least true, but if the inhalation of narcotic gases be artificial and unnatural, so is the swallowing of an emetic root or the application of blistering beetles; every potent remedy and every difference in short between the citizen and the savage is in this sense unnatural. Moreover those women suffer least in labour who are most nearly in a state of nature, and it is but fair that if civil-
zation bring the bane it should also as far as possible bring with it the antidote. Of the medical objections some are absurd upon the face of them, as paralysis in the mother, or idiocy in the child. Some degree of asphyxia in the child was sometimes observed after the use of ether, but almost never, or never, as the result of chloroform. Dr. Barnes, in opposing the practice as apt to produce rupture of the perineum, says "The insensibility of the cerebrum to pain, induced by chloroform or otherwise, prevents the development of that emotional relaxation of the glottis which is the safeguard against excessive diastolic action; but chloroform, if used in some-
thing like a surgical dose, is the very thing to prevent not relaxation but closure of the glottis, and excessive diastolic action too.

For the induction of this much longed for anaesthesia an endless variety of means have been tried. Some of them were mechanical, as constriction of the neck, which was accompanied by convulsions and other disagreeable complications, and accordingly abandoned; or compression of the nerves supplying the part, a process in itself occasioning no little pain. The Phasmonic slumber is said to have been a few times tried with success. Different vegetable drugs have enjoyed more or less reputation, especially man-
dragona and Indian hemp. The preparation used by Hugo of Lucra was a watery extract of mulberry, hemp, henequen, hemlock, burdock, lettuce, mandragora &c. In the experiments of professor Ludwig, at Marburgh, the very same effects as those produced by chloroform were just as rapidly occasioned in animals, by injecting a small portion of a solution of opium into the veins. Vapors, however, are the class of substances that has yielded the best results. From the experiments upon the dogs in the Grotto del cana, and from the frequent resuscitation of people poisoned with it, carbonic acid would seem to be a manageable agent; but its effects are not always so transient and often include closure of the glottis; and the
absence of smell is sufficient to counterbalance any convenience that it has on account of cheapness or high specific gravity 1.527. The employment of nitrous oxide was hinted at, by Sir Humphrey Davy, in these words, “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; and the only wonder is that it was not used, although a gas be not the most convenient thing to apply even in the wards of a hospital, and still less to carry about from house to house. Common coal gas has been found an “effective anaesthetic; but which of its
constituents is the active agent appears not to have been investigated; nor is it now, at least for practical purposes, worth while searching for another anaesthetic having the old objection of a gaseous form. Possibly it may be the olefine gas, for the oil thereof (oil of the Dutch chemists) a substance that may be viewed as its chloride \((\text{C}_4\text{H}_8\text{Cl}_2)\) has, by one or two, been noted superior even to chloroform. This oil has the advantage over the gases of a liquid form, and a vapour of specific gravity 3.448, while it boils at 180°. The substance that has done most for the progress of anaesthesia is sulphuric ether (chemically oxide of ethyle, \(\text{C}_4\text{H}_5\text{O}\)) which had
previously been used, for its other properties, both in medicine and in chemistry. It was found a most certain agent, with a speedy and satisfactory recovery from its effects, and without any positive any positive disadvantage except its great inflammability in the not very common case of an operation by gas or candle light. Its odour too is agreeable enough to the patient, though not so agreeable by adhering to the operator, as it does if he use it extensively. Then comes chloroform, discovered in 1831,2 by Sobirian and Liebig, and ascertained in 1835 by Dumas and Peligot to have the composition $C_2H_2Cl_2$ (perchloride of formyl), prepared by the action of chlori-
mated lime on alcohol. Like, ether it had been used medicinally, though not anaesthetically. It has, in the whole, made good its claim to the advantages over ether which Dr. Simpson introduced it as possessing, the chief of which are that the quantity required is less, the odour more agreeable and less tenacious, and the action more rapid, though of the last being an advantage I am not quite convinced; it is also less inflammable, more volatile boiling at 141°, and less apt to spread, having as vapour a specific gravity of 1.2. A freezing mixture of salt and ice produces complete local anaesthesia, and may probably come into general use for operations on the surface.
as evulsion of nails, and the application of the cautery; yet in the latter the separate eschars have been found to coalesce into one continuous though.

There have been offered one or two fanciful explanations of the modus operandi of general anaesthetics. After mentioning a number of anaesthetics and their compositions Dr. Barnes thus propounds his theory. "It will be perceived that in each of these substances, carbon exists to a greater or less extent, and in all in my opinion it constitutes the active agent," and he refers to experiments with chloroform on dogs, in which the "blood was found to con-
tain an excess of carbon." But this theory entirely fails to account for the very similar action of substance containing no carbon at all, nitrous oxide gas (NO). Dr. Black, of Manchester, has sup-
posed that the inhaled substance acts mechanically, existing in the blood as gas, and that when this dis-
tending vapour reaches the brain in the course of the circulation, its elastic force meets with a con-
terpressure in the resisting case of the calvarium; yet it is difficult to see how a "vapour," entering the circu-
lation by the lungs can reach the head without causing, as it passes the heart, the same fatal effects.
as does common air. Dr. Gull thinks that ether probably permeates every tissue, but acts most upon the nervous
on account of physical constitution, the grey substance of the brain containing 45.5 percent, the medullary
substance 14.5 percent of fatty matter." The narcotism, however, of alcohol, chloroform and nitrous
oxide so evidently akin to that of ether cannot be thus explained unless indeed we are to suppose that
nervous matter contains other ingredients (sulphides, caoutchouc etc.) subject, by "physical consti-
tution," to the action of all three. Of the modus operandi of anaesthetics no more is clearly known than
that it is like that of other stimulants, exciting
the animal functions, deranging, arresting or ex-
tinguishing them, according to the dose. "Braces they are true nanotics." Certain anomalous circum-
stances, such as patients expressing pain yet not remembering it, and others during the time (of an operation) giving sly winks and facetious nods to those around" are apparently not very rare; for M. Wells, M.D. found that in fifty-
two (out of 106 cases) the persons either cried, started, or moaned during the operations, but on recovery said they had felt no pain, al-
though in fourteen instances they were conscio-
ous of what was being done." They are explained.
if not demonstratively at least consistently, by further subdivision. Thus Dr. Snow recognizes five stages or degrees, and reckons that "an operation would cause pain if the etherization were not carried past the second degree, although if the pain should not cause the patient back into the first he would not remember it." and another subdivides finds that "an obscure perception of external objects re-mains, while the sense of pain is extinct."

Upon the risks attending anaesthetics post mortem examinations.
have as yet thrown but little light. No doubt, in a considerable proportion of fatal cases, the heart has been found fatty or else flaccid; but these conditions are sufficiently common in the bodies of patients who have had nothing to do with anaesthetics; and the only appearances at all constantly met with are, as in some other kinds of sudden death, fluidity and blackness of the blood. It was natural a priori to suppose, and accordingly it was supposed, that disease of the lungs would be a contraindication; yet, so little has the dread been confirmed by experience, that, in some hands, chloroform now actu-
ally constitutes the sole treatment of pneumonia. And it would seem too that it may safely enough be used in some kinds of cardiac disease, for in its indiscriminate use it must be given to many subjects of lesions so common. Epileptics were expected to be unfit subjects; but chloroform is now an important part in the treatment of at least the puerperal form of epilepsy. Hypo-
oria has been brought forward as a contraindi-
cation; and certainly some patients upon en-
tering, but more commonly upon emerging from, the domain of an anaesthetic, do exhibit certain symptoms [of which weeping is perhaps
the best marked) of a very hysterical appearance. But it is surely too much to say "that chloroform, administered for the purposes of surgery, invariably produced hysterical symptoms, in all in whom there existed the least tendency to that malady," hysteria is not so rare but that it must be pronounced, in the many females who take chloroform when getting rid of a carious or neurole-gic tooth, in a far greater proportion than would be indicated by its occurrence at the time of operation. Considering the power of the agent and the frequency of its use, the deaths during the inhalation of chloroform have been wonderfully few, and those
occaisioned by it probably fewer still, when we make
allowance for the occasional occurrence of cases such
as used to be suddenly fatal, from emotion or some
obscure cause, before anaesthetics were in vogue. Mr.
Travers gives numerous specimens, e.g. "A lady who
reluctantly submitted to the removal of a small tu-
mour in her breast, unexpectedly, and without any
apparent cause, died on the morning following the
operation. It was then, for the first time, ascertained that
she had prognosticated her death." "A lady entertained
from the commencement of her pregnancy, a morbid
fear of death in childbirth... the labour was in all re-
spects easy and safe... the mother died suddenly in
six hours after delivery . . . every region of the body presented the appearance of health." "I saw a man, who was the subject of strangulated hernia, expire suddenly on the table, during the steps preliminary to the operation, which . . . might be said to afford the fairest prospect of relief." "On entering the theatre, he (a patient with an aneurism) fainted . . . a more attentive observation proved that he was quite dead." "When a man dies under the influence of a drug that must nearly kill him to be of any use, we are apt to forget these other sources of danger, and lay the blame upon the one most
tangible. In the end of 1853, that is six years
after its introduction, Dr. Snow found that
about thirty-five deaths from chloroform had
been recorded in all parts of the world. In the Edin-
burgh hospital I am not aware that any case
proved fatal with ether, and at all events, with
chloroform, there has occurred but one such, out
of probably some two or three thousand operations,
while in London Mr. Potter did not meet with a fa-
tal case till he had administered the drug about
fourteen hundred times, and in that one it was
not certain that the anaesthetic had caused the
death single handed, for "it is reckoned that the patient did not inhale altogether more than twenty minims of chloroform, and further conjectured as "not improbable that the patient, overcome by fear, fell into a swoon, which, by the assistance of a few inhalations of chloroform, paralysed the action of an already feeble heart." For the administration of an anaesthetic, (or rather the anaesthetic) the usual rule is to take care that the vapour be plentifully diluted; while it is added, somewhat contradictorily, to induce the full effect as fast as possible, as if dilution of the vapour was not the very thing to make the process slow. Now though it is doubtless desirable to curtain
as much as possible the stage of shouting and struggling, if it can be done without adding to the risk; yet being too slow is safer than the least degree too fast, for of fatal cases the usual story appears to be that the anaesthetic has taken effect with unusual rapidity. The danger of inhaling too strong a vapour has been well illustrated by Dr. Snow, who found that in animals made to breathe air containing ten per cent. of chloroform or upwards the respiration and circulation ceased about the same time, because there was sufficient vapour in the lungs at the moment the breathing stopped to paralyse the heart when added to that already in the blood. Different operators have their fa-
vomite symptoms of danger or safety, some trusting mainly to the state of the pupil, and one at least to a clumsier index, the relative frequency of the pulse and breathing. But our ordinary guide must be the state of the respiration, for the failure thereof is the most common alarming symptom, and the most common mode of death. Yet there are other things to be watched, for in the Edinburgh and some other fatal cases the action of the heart, which is usually "the last of the vital actions to become arrested," was found to fail before the breathing indicated danger. And these are evidently the most dangerous class of cases; for, should the tongue fail
back into the pharynx it is easily pulled out, should the muscles of respiration fail their place may for a little be, as it has often successfully been supplied by the hands of the administrator or direct mouth to mouth insufflation; but should the heart strike work, it is not so easy to find a substitute or an effective stimulant. If all other apparatus, from the ordinary flask, or two necked bottle, to the most complex machinery of valves and stopcocks, were inferior to the handkerchief of sponge, in the case of ether, they are still more so in that of chloroform. The best position
is the horizontal. The usual quantity for inducing the full effect is about a drachm; a patient of intemperate habits commonly requires more. An indispensable precaution is to have at hand plenty of force to control far more than the ordinary strength of the patient.

Dugald Campbell

Edinburgh

12th March 1855