they alone possessed corporate rights. Henry VIII amalgamated these into one corporate body, styled "barber-surgeons". Apothecaries were members of the City Company of Spicers (now the Grocers), who then imported the drugs of the Levant. Henry placed them under control of the "physicians". These reforms were begun in 1512, by placing the practice of physic and surgery under ecclesiastical surveillance; and they existed in 1540, when the barber-surgeons were incorporated, and were authorised to pursue the study of anatomy in opposition to the sentiments of churchmen. Almost step by step these changes were resolved on during the pressure of foreign wars, which demanded the services of surgeons for the king's armies and fleets.

The barbers followed armies in the exercise of their calling as shavers, hair-cutters, and practitioners of surgery; and from among the barbers of London, King Henry the Fifth's surgical staff at Agincourt was selected by Thomas Morestede, who was sergeant-surgeon to Henries IV, V, and VI. The utility of his staff on that occasion, would naturally assist in obtaining their charter from Edward IV. King Henry VIII commenced the reform of our profession before that of the Church. In the third year of his reign, A.D. 1512, he gave to the Church the control of our profession, both medical and surgical, by ordaining that all practitioners, except those having degrees of medicine from Oxford or Cambridge, should be examined by the clergy, assisted by medical graduates or surgical experts in each branch respectively; the Bishop of London and Dean of St. Paul's being the assessors for London and within seven miles thereof; and in the provinces, the bishops or their vicars-general. In the fifth year of his reign, A.D. 1513, it was enacted that all barber-surgeons should be exempted, *as in time out of mind, from bearing arms*, "with privileges like heralds", as well in battles and feldes of warre, because they be persones that never used feates of warre, nor ought to use, but only their besynes and exercise of their science to the helpe and comforth of the King's liege people in the tyme of their nede;" also exempting them from serving on inquests, juries, and watch in cities.

It is pertinent to our subject to remark, that these important privileges were confirmed to surgeons of all degrees, under the pressure of war—England being then at war with France and Scotland—Tournay being captured, and Flodden fought in that year, but their first privileges related to those who served in the field; while physicians, who were less in demand there, did not secure the same municipal exemptions until 1540, when, it must be noted, that by the same Act the College of Physicians was recognised to be competent to give licenses in surgery as well as in medicine, thus extending the field from which surgeons might be drawn for the king's service. These facts illustrate how much the profession at large gained, during its early organisation, from the warlike services of a portion of it.

In the tenth year of his reign, A.D. 1518, he gave to the Royal College of Physicians its first charter, being incited thereto by the example of the Italian states, and other nations, and by several physicians, among whom were Drs. Chambre and Linacre, and by Cardinal Wolsey. By this charter, the higher grade of our profession was entrusted with self-government in the power of electing its own president and examining officers, with powers to punish offenders by fine and imprisonment, etc., in and within seven miles of the City of London. This charter was renewed, and was confirmed by Act of Parliament in 1523, with the extension of its licensing powers throughout England. Verily, this must be regarded as the Act of Emancipation of the profession of medicine from that Church which had leagued it with astrology and the occult sciences, and had degraded surgery to the status of a handicraft exercised by barbers as such; and in furtherance of that elevation of the profession, by another Act of Parliament, 1530, 22 Henry VIII, surgeons are defined as "not being handicraftsmen." It seems significant of the inherent power of the profession that, as soon as its autonomy was recognised, these changes occurred; but it lay still within the pale of the Church of Rome, for it was not till 1534 that Henry's quarrel with the Pope became irreparable.

In 1538, the cultivation of anatomical knowledge, as the true and sure foundation of surgery and medicine, was recognised by an Act of Parliament, legalising dissection at the Hall of the Barbers.

In 1540, the thirty-second year of his reign, the king placed the capital on the stately edifice he had raised for the development of our profession, by uniting the two bodies which legally practised the science and art of surgery, under the single incorporation, by royal charter, of the Barber-Surgeons' Company of London, to the end that, by their association in the same hall, the science and art of surgery might be improved generally. In order that the study of anatomy might be encouraged, it was enacted that the Company "may take annually the corpses of four condemned felons put to death, to make incision, etc., for their further and better knowledge, etc., of surgery." It ensured, at the same time, the separation of pure surgery from the art of the barber, by enacting

that no barber shall practise surgery, except the letting of blood and drawing of teeth, and that no surgeon shall exercise shaving or other feats of barberie.

It confirmed also to this united company the authority which Henry V had originally conferred on Thomas Morestede, to impress surgeons for the king's service, both within and without the privileges of the City of London. Of the warders or examiners, two were to be experts in surgery and two experts in barberie: which continued until the fifth year of James I, who, in granting a new charter, ordained there should be ten examiners for the license, *all being surgeons*.

From that period, surgeons became virtually distinct from barbers, although incorporated in one company, and using one hall in common; but, by the bye-laws of the company, the masters, elected annually, were alternately a surgeon and a barber, who signed the licenses of the current year; which practice became an offence to the surgeons. The connection of these facts relating to the renaissance of our profession, shows that, from the days of Henry V, our monarchs kept steadily in view one point as essential to the interests of the state, viz., the encouragement of that branch from which surgeons were to be drawn for the service of the state. The surgical staff of the armies of Henry V and Edward IV was drawn from the barbers of London, and their services led to corporate rights and privileges. Henry VIII enlarged those immunities, when he was at war, on finding only *twelve men* constituting the "fellesskip of the crafte and mysteries, surgeons enfranchised". At a later period of his reign, he amalgamated those who practised surgery, in one body; and, from a desire to multiply surgeons, he assigned to licentiates of the Royal College of Physicians the right to practise surgery, and pronounced surgery to be no longer a mere handicraft. State necessities may be assumed to have been the urgent reason for this patronage of a hitherto inferior calling; and it may be safely asserted that these necessities contributed, in no mean degree, to arouse and direct the energies of statesmen to organise the profession, so that the state might benefit by its services in war; and thus the profession at large, and the surgical branch of it in particular, owe many of their immunities to that cause. That branch has risen in importance paramount with that of the physician, but not without a struggle, prolonged throughout the seventeenth and eighteenth centuries, to free itself from the position of inferiority into which long usage and church influence had thrown it. Throughout that struggle the surgeons obtained support from the independence of position of those of their number who served in the navy and merchant service, where they were compelled to undertake cures of internal diseases as frequently as of wounds, and were, in the former service, provided with the means of doing this, by the king's authority, at the expense of the exchequer.

[To be continued.]

REMARKS ON THE PRODUCTION OF SLEEP DURING SURGICAL OPERATIONS.

By JOSEPH T. CLOVER, F.R.C.S.

SINCE the introduction of anæsthetics, there has never been a period when the opinion of surgeons as to the best way of saving pain was more unsettled than it is at present; yet it is a matter in which every practitioner in the country has had some share of experience, and questions as to the relative safety of various anæsthetics are often put by patients with the greatest anxiety. Our time will not be misspent, if we can make a decided step towards the settlement of these questions.

It may be truly said, that there is danger in every kind of inhalation, if in time, or quantity, or some other circumstance, it have been administered in excess. And there are *conditions of safety*, if we only knew them, that would make all the anæsthetics perfectly free from danger. No one, who has had much experience with anæsthetics, can look back without remembering some case in which threatening symptoms have occurred. Of these symptoms, some have been found to be of slight importance, although very alarming to an uninformed bystander; and some, on the contrary, where, although the lookers-on can see nothing amiss, the administrator knows that the patient is in imminent danger if the anæsthetic be not removed. I shall endeavour to illustrate my meaning further on.

I have been unable to account for the strong opinions to be found in the correspondence of the weekly medical journals, in any other way than by supposing that the results of small doses or brief inhalations of one agent have been compared with the larger doses or more prolonged inhalation of another. When we consider that with every known anæsthetic it is an easy matter to destroy the life of animals by concentrating or prolonging the dose, it will appear that it must be a

matter of some importance, for the purpose of forming a judgment upon the merits of them, to settle some plan of giving the agents by which the *degree of concentration* as well as the *time* of inhaling is known.

Before speaking of special anæsthetics, I may bring forward some physiological considerations which apply to them generally.

I suppose it will not be disputed that, in administering chloroform, for example, the effect we want to produce is the entrance of a certain quantity into the blood. We know that, in experimenting upon animals, we cannot produce such quietude as is needful for operations without putting a certain proportion of chloroform into the air they breathe; and further that, if the proportion be increased beyond five per cent., the animals will die in a few minutes. The mode of dying varies. If the chloroform enter the blood slowly, the heart will go on beating after the breathing has ceased. On the contrary, if the blood be quickly and strongly charged with it, then the heart stops suddenly, and the breathing continues for a considerable period afterwards.

Some animals are less liable to cardiac syncope than others. In dogs, for example, unless some pains be taken to give a very strong dose, the respiration stops first. The same results happen to man; but many circumstances tend to obscure the facts. Thus, although we can limit the maximum proportion of chloroform which can possibly enter the blood by limiting the proportion of vapour in the air inhaled, we cannot so accurately determine the *minimum* amount which will actually be taken up out of the same atmosphere. *The blood never takes up the maximum amount of chloroform from a given atmosphere, except when the most effective respiration and the slowest circulation of blood concur with muscular exertion and closed glottis.* In very tranquil breathing, the fresh air may go no further into the lungs than the primary bronchi; and then the oxygen enters, and the carbonic acid escapes imperfectly by diffusion. During such breathing, the chloroform enters slowly by diffusion into the nearest pulmonary cells, whilst the more distant scarcely receive any of the vapour. The blood circulating through these distant cells is unaffected by the chloroform, and dilutes the blood, which has absorbed chloroform from the nearer cells. Contrast with this what happens in forced breathing. The contents of the lungs (except a small amount of residual air) are expelled, and fresh air containing chloroform is brought by each inspiration into the pulmonary cells. Under the excitement of delirium, in the early stage of narcotism, patients often breathe deeply and rapidly, and the stertor that follows is unusually pronounced; and it is in such cases that cardiac syncope may come on, even although the percentage of chloroform is not in excess of what is usually required. The syncope is the result of the large proportion of chloroform entering the blood and acting upon the ganglia of the heart.

If now, whilst there is this rapid supply of fresh chloroformed air, the circulation through the lung be retarded, and especially if, by the shock of an operation, the heart intermit and the blood for a second or two remain stagnant in the capillaries of the air-cells whilst muscular efforts are made, the absorption of chloroform is carried to the highest point; and, when the failing heart revives, the first blood it sends into its own substance will be stronger of chloroform than any it had yet received, and life will be in the greatest peril.

The effect of great muscular exertion in causing temporary faintness, when no anæsthetic has been breathed, is familiar to all of us. The heart, like all other muscles, loses some of its irritability from severe exercise. These considerations have induced me to take off the chloroform for at least one inspiration, whenever a patient has made a violent effort with closed glottis.

When ether or chloroform is inhaled, the throat is stimulated; coughing and movements of deglutition commonly occur; vomiting even is sometimes directly excited, if the vapour be very strong. The act of swallowing is usually performed well enough; but, if the anæsthetic have produced sufficient effect upon the patient to interfere with reflex movements, then the deglutition may be delayed at the moment when the epiglottis covers the larynx. Raising the chin, and pulling it as far as possible away from the sternum, is usually sufficient to obviate this source of obstruction. If any one will try the experiment of attempting to swallow with his chin considerably elevated, he will find that he cannot do so without lowering it. When chloroform or ether vapour of greater pungency is given, there may be a direct spasm of the glottis produced. A similar spasmodic closure often occurs when nerves are pinched or divided in the course of an operation. It commonly occurs when a ligature is applied to a hæmorrhoid.

I have never found it necessary to take hold of the tongue with forceps; but I advise that they should be kept ready, for it may be that the greater pungency of the vapour, when applied freely, causes an obstruction which raising the chin will not remove; and in such a case we must not be afraid of hurting the tongue.

Ether.—I was a junior student at University College, and saw Liston

perform the first capital operation under ether that was done in this country. Although it continued to be used in certain cases in the operating theatre, there were objections to it which even now are but partially removed. The struggling against it, and the strange things patients said and did under its influence and whilst recovering, made us receive chloroform gladly, as a more convenient and less disagreeable agent. It was given with much freedom, until a death occurred at Newcastle in the practice of Sir John Fife. Of late, chloroform accidents appear to have increased, and thus medical men have very properly been stimulated to seek for a safer anæsthetic. Ether is undoubtedly safer; that is to say, life is not so quickly destroyed by it. But, nevertheless, I have seen a strong dog killed in sixteen seconds by being made to breathe pure ether through a tracheal opening. In the case of death at the West London Hospital after inhaling first chloroform and then ether, the patient had recovered from the chloroform so far as to have a fair pulse; but it ceased to beat very soon after the application of ether by means of a sponge made warm with water. The chloroform had, I suppose, sufficiently narcotised the patient to prevent the usual obstruction to strong vapours by closure of the glottis. If we are prepared to resist the remonstrances and struggling of the patient, ether may be poured upon a hollow sponge or towel folded into a cone, or upon a cone of felt covered with oiled silk, and held over his face. The patient will resist breathing, at first voluntarily, and afterwards more or less spasm of the glottis will be produced. The blood will be imperfectly oxygenated; and insensibility will be produced in a short time, partly from deprivation of oxygen, and partly from the action of ether. Less ether enters the tissues of the body in this way of giving it; and, if the operation last only two or three minutes, the recovery of consciousness will be speedy. Headache is not rarely complained of. Sickness is about as frequent as after a moderate use of chloroform. The patient sometimes remembers the choking sensation, and will not inhale it again if required. The flow of saliva is considerable; and the larger air-tubes are often obstructed by fluid, which makes a loud moist rhonchus; but it does not appear to be of much consequence, as it goes off afterwards.

I think most English surgeons are in favour of giving the ether slowly for about a minute or so at first; and then, when some degree of anæsthesia has come on, to give the vapour strongly. I am decidedly in favour of this plan, and have sometimes succeeded in getting a patient to sleep without any struggling. The most pleasant way is to give nitrous oxide till consciousness is lost, and then administer the ether of moderate strength. I should be afraid of giving *pure* ether by means of a large warmed sponge to a patient already well narcotised, for reasons already mentioned.

I have given ether a good many times by means of a bag, smaller than the one in my chloroform apparatus. The bag was regularly supplied with air, which passed over a large surface of ether, kept at the temperature of about 68 degrees, at the rate of about five hundred inches per minute. I have for the present put this aside, and make use of what I term a double-current inhaler for ether. The object of this instrument is to effect a mixture of ether and air of the strength required. The internal arrangement is on the plan of an ordinary still, supposing the worm to be covered with calico for holding the ether. The ether is kept at a comparatively uniform temperature, the coldness produced by the evaporation of the ether during inspiration being balanced by the condensation of ether and watery vapour during expiration. The valves are so placed that the inspired air passes over the ether, and the expired air passes through the condenser. The ether in the upper part of the vessel being kept several degrees lower than the patient's breath, it is impossible for the proportion of ether-vapour to exceed a certain point. This proportion is more pungent than is usually required, and is diluted at pleasure by a sliding valve which admits air without passing over the ether. The advantages obtained are—1. The power of graduating the dose so as to avoid very much of the unpleasant pungency of ether as commonly administered; 2. Diminution of the smell of ether in the room; 3. It may be used in hot or cold weather without any water-bath, and the use of glass is avoided; 4. Economy of ether; 5. Saving of time. It can be kept ready for use, and will serve for four or five cases without adding more ether.

Directions for Use.—1. Put ether into the apparatus, after removing the inspiring valve, until the vessel is filled to the level of the bottom of the tube. About ten ounces will be required. 2. Refix valve and cap, and rotate the box slowly on its long axis, to distribute the ether over the calico on the outside of the condenser. 3. Open the regulator, remove the three caps, and apply the tube with face-piece. 4. After using, pour out condensed vapour. It will generally be found convenient to suspend the inhaler by means of the strap passed round the neck; but as soon as the patient is asleep, if not before, it can be placed upon the couch. The condensed ether-vapour might be saved

and redistilled, if the apparatus were extensively used in hospital practice. In order to prevent the escape of ether-vapour from the apparatus when not in use, I keep it in a tin box, the front and sides of which are double, so as to form a trough for water, into which the lid of the box is immersed. Of course, if the box be heated, the air inside may expand and escape in bubbles; but very little vapour is lost in this way.

Morgan's inhaler consists of a metallic vessel with a diaphragm of India-rubber membrane, which rises and falls with the breathing. This arrangement effects the same result with ether which I produce by the supplemental bag of my nitrous oxide apparatus. The patient inhales almost the same atmosphere over and over again, the ether and carbonic acid increasing, and the oxygen diminishing. I have used it, and found it both effective and economical. It also wastes very little ether about the room. I think more headache was complained of, and that there was rather more sickness, than when I have used my own apparatus, which allows the escape of most of the expired air without being breathed twice.

In Norton's inhaler, the ether is kept at the required temperature by a water-bath. The air passes over it during inspiration; but the expired air is carried off by a tube to the floor, to diminish the smell of ether in the room—an effective arrangement, but scarcely equal to Morgan's in this respect.

For operations about the mouth, which prevent the use of the ordinary face-piece, a small nose-cap connected with the inhaler will sustain the anaesthesia, especially when the patient has been kept fully five minutes under the influence of ether after insensibility of the skin has been induced. In such cases, it is well to be provided with a tin tube an inch in diameter and a foot long, lined with blotting-paper; and, if required, to pour ether into it, and hold it near the mouth, so that the weight of the vapour will cause it to flow into the mouth during inspiration. Ether is well suited for these operations, because, if the administration have been continued long enough to get the tissues well soaked with ether, the anaesthesia is kept up longer than is usual after the withdrawal of other anaesthetics. Ether is also well suited for short operations for which nitrous oxide is inapplicable. The complete muscular relaxation produced by ether renders it by far the best thing to use in reducing old dislocations. It is called for in cases where the system has been injured by intemperance with alcohol, or when there is reason from any cause to believe the heart exceptionally weak. In cases of phthisis or emphysema, I should prefer to give chloroform.

Chloroform.—Next to nitrous oxide, I think chloroform is the least unpleasant anaesthetic to breathe. Patients who have previously taken chloroform are often unwilling to try nitrous oxide, because they have no objection at all to the former; but I have rarely found a patient who had once been put fully under the influence of ether, who was willing to inhale it again, unless it had been preceded by nitrous oxide.

Much has been said against chloroform, on account of the sickness which follows its use. I do not find it occur on an average more than once in seven or eight cases. The morphia or other preparations of opium, which are often prescribed after operations, will account for some of the cases of obstinate sickness. I admit that chloroform has more deaths to account for than ether has; but we must not forget that chloroform is much more frequently administered than ether, and that coroners' inquests are not held in countries where the practice of giving ether instead of chloroform is prevalent. Still there are greater dangers from chloroform than from ether, although I do not think them so insidious that every one who inhales it runs even an infinitesimal chance of losing his life.

The proportion of chloroform to the blood which will destroy life varies according to the species of animal, and in some slight degree according to the individual, but there is no animal that may not easily be killed by a full dose; and therefore, whatever way we give the chloroform, it must be only a reasonable precaution to endeavour to avoid reaching that dose.

I have already explained how it happens that one person whose breathing is *excessive*, whilst his pulmonary circulation is *slow*, may get as much chloroform into the blood of the pulmonary veins, from air which contains a moderate quantity of chloroform, as another person, whose breathing is *feeble* and whose pulmonary circulation is *rapid*, may get from air which contains a much larger proportion of chloroform. Therefore, in whatever way the chloroform is given, the condition of the patient's pulse, as well as his breathing, should be carefully watched all the time he is inhaling; and, when the breathing is deep or the pulse weak, the chloroform should be diminished or removed. In the administration of anaesthetics generally, but especially in giving chloroform, it is advantageous to have the stomach empty or nearly so. I like to give a teaspoonful of brandy, without water, a few minutes beforehand, but not so much as a tablespoonful. If wine

be given, or if the patient must have some water with the brandy, then they should be given half-an-hour before inhaling, to allow time for their absorption. Emphysematous subjects, especially, ought to avoid inhaling after a meal, but I do not consider them bad subjects for chloroform. The majority of fatal cases have had good lungs; and, seeing that it is by free respiration that the greatest amount of chloroform enters the blood, we should expect cardiac syncope to happen less frequently in cases where the respiratory function could not be much increased by excitement. It will appear a strange opinion, but I say advisedly, that I think there would be less danger from giving chloroform to the out-patients of a consumption-hospital, than to the same number of distinguished athletes. The subjects of advanced fatty degeneration are bad subjects for any excitement or any anaesthetic, but we have no reliable means of diagnosing such a state. I believe I have given it several times when the heart was fatty. Where the disease is believed to exist, greater caution should of course be used, and it would be well to add one-sixth or one-eighth part of ether.

Modes of Administration.—According to my experience, the safest and least disagreeable way of giving chloroform is by means of an apparatus I introduced twelve years ago, which measures both the air and the chloroform which is mixed with it. It will be objected to on the ground that deaths have happened from chloroform where it has been used, and that it is liable, if seldom used, to get out of order; so that, for example, we may measure out only 700 or 800 inches of air instead of 1000. I admit this, and do not advise any one to use it at all who is not likely to use it often, or who is not disposed to give a little time to keep it in order.

I will defer making any remarks upon the fatal cases, merely mentioning, as the result of my inquiry, that I know of no case where death resulted when not more than thirty-five minims of chloroform was mixed with 1000 inches of air, and when the pulse was felt all the time the chloroform was given. I find that 32 minims per 1000 inches is quite strong enough, except where it is impossible to make the face-piece fit closely on account of the beard and moustache; but, even for such cases, I would not advise more than 34 minims. The best kind of face-piece for this and similar inhalers is one made of tin or thickish lead. The edge should be covered with leather or velvet, and further protected by a movable covering of chamois leather. This covering may be tied on with string; but the best plan is to have the edge perforated, and elastic thread passed through all round and fastened. By this means, the cap is kept in its place without the trouble of tying it, and it can be reversed and used again. It is a slight modification of Dr. Sibson's face-piece. Five or six years ago, I had the edge of the face-piece protected by an inflated air-cushion of India-rubber. Finding that these cushions collapsed, I had them filled with water, or with a little treacle, which answers the purpose of keeping the cushion airtight. Dr. Sibson made use of India-rubber for valves, which I found liable to curl up from the effect of chloroform. I have had valves made of a disc of vulcanite, which fits over the edge of a cylinder, and is kept closed by a fine spiral spring. They act well in whatever way the face-piece is held, and seldom get out of order. A sort of tin cap, to fit over the edge of the face-piece, is an useful protection for the soft metal, when an extra face-piece is carried in the pocket.

Dr. Snow's and Sansom's inhalers are conveniently portable. Although they do not supply the vapour with so much precision as my own, they are much better than a towel or handkerchief.

Skinner's plan is a good and effective one for general practice. It requires less care in adjusting it to the face. The chloroform is supplied from time to time with a drop-bottle upon a flannel mask supported by a wire frame. An ingenious addition to this apparatus has been made by a French surgeon, by which the same hand that holds the mask can supply chloroform drop by drop to the flannel, and thus the other hand is left free to feel the pulse. The weak point of it is that, if the patient should struggle, the bottle might be displaced or broken.

I think some material might be found which would show more distinctly than flannel does the amount of chloroform which remains in it. If supplied too freely, chloroform might drop through the flannel upon the patient's face.

A towel folded and made into a cone, with an opening at the top, is a very effective plan; but if (in order to avoid removing it frequently, for the addition of chloroform) more than a drachm be supplied at first, the vapour may be given off more freely than is safe. A handkerchief or lint, folded to about six inches square, and supplied with ten or fifteen drops at a time, is, I think, a better plan.

If I did not use any special apparatus, I would fold a piece of lint into a compress, of the size of a walnut, and tie it up; then pour upon each end of it a drachm of chloroform, so as to let it penetrate the lint

without wetting all the surface; then let the patient smell at it at the distance of two inches, and gradually cover my hand and the patient's face with a towel; by warming the lint with the palm of the hand, nearly the whole of the chloroform can be evaporated slowly. It is known, by its no longer feeling cold, when the compress has become nearly dry and needs to be supplied with fresh chloroform. Not more than thirty minims at a time should be added after the first charge.

Of course, the proportion of chloroform in the atmosphere breathed is, in most of these ways, modified by circumstances: *e.g.*, by the temperature of the room, and of the chloroform at the commencement; then by the amount of cold produced by evaporation of the chloroform; by the distance the chloroform is held from the mouth; by the temperature of the hand, and the manner of holding the chloroform.

The slowness with which a timid patient inhales causes so much delay, that the administrator is sometimes induced to augment the dose; and then, when consciousness is lost, the patient is very liable to get more of it than is safe. Not a few alarming cases have had no bad symptoms until fresh chloroform was supplied; and then, in from a quarter to half a minute, as soon as there has been time enough for the new atmosphere to tell its effect on the heart, syncope has taken place.

Chloroform is said to prevent the shock of an operation; and it certainly does so to a great extent. We do not find fainting so common as it was before chloroform was used; but I have often felt a weakness and irregularity, and sometimes a decided arrest, of the pulse at a time when extensive incisions or injury to nerves has occurred. I think that a patient should have his pupils insensible to light, or breathe stertorously, before the commencement of a severe operation; but that one or two inspirations of pure air should be taken before the anticipated shock is given.

Methylene.—The so-called methylene bichloride is a compound body, similar in many respects to a mixture of chloroform and ether and alcohol. When put into a test-tube, with the bulb of a thermometer fixed just above the level of the liquid, and boiled, the temperature rises steadily; the more volatile substance escapes until the boiling temperature of chloroform is passed. The same rise of temperature occurs when we boil a mixture of ether and chloroform and alcohol.

It may be noticed also that, as the methylene is boiled, the smell of the residue becomes more and more like that of chloroform; but this odour diminishes again as the fluid is nearly dissipated. I do not suppose it to be simply a mixture of the substances named, but I think there is sufficient chloroform in it to make it unsafe to use it with the same freedom that ether may be used.

I have notes of about one hundred cases in which I gave it. Many of my patients were very efficiently and pleasantly put to sleep by it, and awoke with signs of cheerfulness, not usual after the use of pure chloroform; but in other cases there was very undesirable excitement. In one case, the respiration and pulse ceased, and I had to resort to artificial respiration to restore the patient. After this case, I felt less confidence in giving it than chloroform, and I now very rarely give it from choice.

In administering it, I sometimes used a cone of leather lined with flannel. The pungency of the vapour, when given in this way, makes patients often resist and struggle against it, so I more frequently gave it with my chloroform apparatus, using about sixty minims to each one thousand inches of air. I did not find sickness less frequent than after chloroform. I think it is an useful mixture, but it should certainly be used with caution, not only because it contains chloroform, but because the quantity of chloroform given off is not always in the same proportion to the more volatile ingredient. Methylene ether made by adding ether to the methylene bichloride would be liable to the same objections in a less degree.

Mixtures of Chloroform with Other Things.—I find that four to eight minims of ether and thirty minims of chloroform with one thousand inches of air mixed in my bag, answer very well. It sometimes produces more excitement than chloroform alone, but it certainly tends to make the immediate recovery from chloroform more pleasant, and keeps up a better pulse.

The addition of a fourth part of chloroform with one of ether will make the administration of ether on a towel much easier; but, inasmuch as it must be forced upon the patient more than chloroform alone, and the patients are almost sure to struggle, I have not used it very frequently, and cannot advise it.

I have used a mixture of alcohol, one part; chloroform, two parts; ether, three parts; and like it much, for cases where moderate narcotism has to be kept up a long time—*e.g.*, when caustic chloride of zinc has been applied to a cancerous growth. I have tried, in a few cases, tetrachloride of carbon, ethyliden chloride, and most of the other anæsthetics that have been recommended; and the conclusion at which I have arrived is, that they are neither safer nor more pleasant than ether and chloroform;

and, if not decidedly superior in these respects, it is better to continue the agents we are most familiar with.

Nitrous Oxide is an anæsthetic of a very different character to the preceding. I had the pleasure of showing the use of it at the Oxford meeting. Since that time, I have given it in 6,960 cases. When successfully given, the patient appears to fall asleep without any delirium or excitement; but, if the operation be one leaving much pain behind it, the patient sometimes will have a dream more or less connected with it, and then wake up rapidly and completely. It is by far the best anæsthetic for many short operations, such as the extraction of teeth, opening abscesses or boils. It answers very well in operating for strabismus. Removal of the eyeball was performed lately by Mr. Bowman for a lady, who said she had no consciousness of the operation. It is well suited for examining hysterical cases, wrenching stiff joints, and reducing luxations of recent date. I do not think it suitable for cases where it is necessary to keep the patient quiet more than three or four minutes; but, if the patient be allowed to recover consciousness after one inhalation before another is commenced, the anæsthesia may be kept up tolerably well for half an hour. I have never kept a patient unconscious for more than between six and seven minutes; but, if quietude is not important, I have no doubt that a patient could be prevented from feeling pain for an hour. But, although this is possible, I am sure the recovery afterwards would not be satisfactory. When chloroform or ether has been given for ten or fifteen minutes, a state of anæsthesia continues for some time afterwards; but the sensibility to pain returns within two minutes of ceasing to breathe the nitrous oxide, and therefore, in such operations as tying hæmorrhoids and minor amputations, which might, from the short time they take, be thought fit cases for nitrous oxide, it would be unsatisfactory to the patient on account of the after-pain.

In administering nitrous oxide, a plentiful supply of gas is essential to success. There is no fear of patients inhaling too much at first; indeed, they should be told to breathe deeply and slowly. They often disobey the latter part of the advice, and pant as if they could not breathe too rapidly. A supplemental bag was my first contrivance for preventing air from being drawn under the face-piece, and for obviating waste of the gas in cases of this kind. I have now accomplished the same object by keeping the inspiring valve open, so that a part of the expired gas is driven back through it into the bag. I find that I can prolong the sleep of nitrous oxide during operations in the mouth by having the nose-cap and mouth-piece separate, and retaining the nose-cap in its place whilst the operation goes on. The supply of gas must be kept up freely, for, if a little air be drawn in by the mouth, the patient will soon become unsteady, if not actually sensible to pain. Gas is sometimes required where, from the inflamed state of the cheek or lips, the pressure of the face-piece could not be borne. A cap, of the size of the face, formed in front of a piece of glass, and of tin and India-rubber at the sides, answers exceedingly well, but a great deal of gas must be wasted to ensure success. It is a good plan to cover the eyes during recovery, as a bright light or any moving object may cause an unpleasant dream.

If nitrous oxide should prove fatal, I think it will happen from the occurrence of syncope, from some other cause, during the inhalation. Arrested breathing would soon be remedied by artificial respiration, if the heart were beating. I have, on three occasions, been obliged to resort to this means, and the recovery in all cases was satisfactory in less than three minutes.

Nitrous oxide may be used with advantage to prepare the way for giving ether; but I would not advise it before giving chloroform, because, firstly, chloroform is not very unpleasant if given gradually, and, secondly, it would be more dangerous to give chloroform in the state of excitement from gas than without it. I have used gas preparatory for ether in two ways. 1. By means of a bag of gas, I make the patient unconscious, and then give the ether as usual; but the patients sometimes wake up enough to struggle against the ether. We should be prepared for this, otherwise the patient may remove the inhaler and remain several minutes longer in a state of excitement. 2. By using a small bag which is supplied with gas during the inhalation, and by diverting the current of gas and making the supply of gas pass over ether, as soon as the patient loses consciousness, enough ether can be got into the system this way to keep up anæsthesia for three minutes with the mouth open. It is, therefore, well suited for small operations in the mouth, such as the extraction of difficult teeth. The best time for inhaling gas is when the stomach is nearly empty. If the state of the stomach would cause nightmare in ordinary sleep, it would also in that of nitrous oxide. About once in five hundred cases, I have known the patient to pass urine whilst under gas, the explanation being, that the bladder was so full as to require a voluntary effort to retain the urine.