golden variegated ash, which were inserted into common ashes, all died except one; but the ash-stocks were affected, and produced, both above and below the points of insertion of the plates of bark bearing the dead buds, shoots which bore variegated leaves. Mr. Brown, of Perth, observed many years ago, in a Highland glen, an ash-tree with yellow leaves, and buds taken from this tree were inserted into common ashes, which in consequence were affected, and produced the blotched Breadalbane ash."

These instances must suffice here; but I am glad to say that both Dr. Masters and Mr. Darwin have noticed the analogy which exists between these phenomena and those of the zymotic diseases. "Adverting now to the effect produced by the scion on the stock," says Dr. Masters, "it may be said that we have here an operation something akin to vaccination." And Mr. Darwin says, "It is certain that, when trees with variegated leaves are grafted or budded on a common stock, the latter sometimes produces buds bearing variegated leaves; but this may perhaps be looked at as a cause of inoculated disease."

It has now been shown that there is a very close analogy between the phenomena of contagion and those of reproduction, and still closer between them and those of grafting. This is the reason why I have called the hypothesis advanced here the Graft-theory of disease. The question now is, how far this hypothesis will account for the phenomena of the zymotic diseases. I shall very briefly apply the hypothesis to the explanation of the phenomena of small-pox and of its allies; and it need scarcely be remarked that I can only seize at present upon the most prominent features of those diseases, without being able to enter into minute particulars. When a drop of vaccine fluid is placed upon a scratch in the arm, the effect produced is so well known that it is needless to describe it. This effect is said to be specific, and if by this be meant that the vaccine vesicle is different from what would be produced by any other agent, it is no doubt true; but if it be meant that the effect produced by the vaccine fluid has nothing in common with other morbid processes, it is not true. A chemical or mechanical irritant may be made to produce a pustule having many characters in common with the vaccine pustule. Passing over the disagreements in outward conformation between those pustules, the greatest difference between them is that the latter can produce its kind by inoculation upon a sound individual, while the former can not. But this difference is one more of degree than of kind, since ordinary inflammatory products frequently possess inoculable properties. Inflammation of the conjunctiva has been produced by inoculation with the discharge from ordinary ophthalmia; and the experiments of Dr. Sanderson show that inflammatory products may be made to assume highly contagious properties.

But inflammatory contagion declares itself not only by producing the disease upon a healthy individual, but also by spreading the morbid process within the organism of the individual first affected. We see surrounding any inflammatory centre a red areola, indicating that the morbid process is being communicated to the surrounding tissues; and if the primary inflammation be violent or prolonged, we also find enlargement of the neighbouring lymphatic glands, indicating an extension of the morbid process to these structures. But the process does not stop here. If the primary inflammation be still more severe, units of the morbid product enter the systemic circulation and produce inflammation in various parts of the body, especially in the internal organs. But this extension of disease from a primary centre—first to lymphatic glands, and second to other parts of the body—is not true only with regard to inflammation, but we meet with the same order of facts in syphilis, tuberculosis, and cancer. It is also very important to notice that whatever may be the nature of the primary morbid process, it tends to impress its own characteristics upon the disease of the glands and other parts of the body which result from it. In syphilis, for instance, the chronic induration which surrounds the primary sore shows itself in the chronic enlargement of the neighbouring lymphatics, and is more or less apparent in almost all the subsequent lesions which occur during the protracted course of the disease. A tuberculous gland and a cancerous tumour also each tend to generate their kind in the other parts of the body. Taking these facts along with us, we may now return to the consideration of the vaccine vesicle. On the fifth day after the insertion of the lymph, a red areola forms round the vesicle, and the neighbouring lymphatic glands begin to swell. Feverish symptoms also make their appearance about this time. On the tenth or eleventh day, the fever is at its height, and both the swelling of the glands and the red areola are greatest. The course of events so far, then, is not much different from what occurs in an ordinary pustule, except that the rapidity of the evolution of the vaccine vesicle is greater, and its intensity of action very much higher. We have found with regard to other diseases that the morbid process tends to spread throughout the organism; nor are we without evidence that such is the

case with the vaccine vesicle. What is known as Bryce's test clearly proves that as early as the fifth day the skin over the body has already undergone some modification, since the vesicle which results from a second vaccination performed on that day goes through its evolution so rapidly that it will be at its height, and will decline and disappear as early as the vesicles of the first vaccination. But the action of the vaccine vesicles on the organism at large does not stop here. About the eleventh day, a lichenous, roseolar, or vesicular eruption occasionally appears, which continues for about another week. These spots appear to be abortive vaccine vesicles which would, if the action were more intense, go through stages of evolution similar to those of the primary vesicle. This is rendered probable by the fact that, when a healthy individual is inoculated with small-pox matter, the secondary eruption appears about the eleventh day; and the vesicles of this eruption are similar in every respect to the primary vesicles. We have already seen that the secondary affections of inflammation, tubercle, and cancer, generally occur in the internal organs; but, in the case of small-pox, they occur in the epidermis. Why this should be the case, I cannot fully explain. This belongs to the speciality of the disease; and I wish at present to dwell upon the circumstances in which small-pox agrees with other diseases. One reason why the secondary affections should occur on the surface of the body in the contagious diseases is that, in any other case, infectious particles would not be cast off the body, and the disease would cease to be contagious. Natural selection, therefore, which acts in preserving diseased as well as healthy tissues, would preserve those particles which produced their secondary action on the surface of the body.

I cannot dwell further on the agreements between small-pox and the zymotic diseases generally and other diseases; but, in conclusion, I shall make a few remarks upon the difference between them. We have already remarked that the great difference between the vaccine and an ordinary vesicle is the rapidity and intensity of action of the former; and this is true, to a great extent, of the whole course of the zymotic diseases. Small-pox, for instance, goes through its evolution in a limited number of days, while tubercle and cancer require months or years to pass through their evolution. But rapidity of action means that the units of the morbid tissue are rapidly generated; and rapid multiplication of units involves a diminution of their bulk, since the same portion of tissue may consist of a few large or numerous small units. Rapid multiplication of units also renders free access of nourishment necessary; hence there must not only be abundant assimilable nourishment surrounding the units, but the cell-wall must either be very thin, or disappear, so as to allow it readily to permeate their substance. This disappearance of the cell-wall again renders the growth discontinuous—that is, the individual units are rendered independent of each other, so that they can disperse through the organism or become detached. The morphological characteristics, therefore, of highly infectious tissues are rapid multiplication and diminished bulk of units, great thinness or absence of the cell-wall, and discontinuous growth.

ON ETHER AS AN ANÆSTHETIC, AS A SAFER AND MORE EFFICIENT AGENT THAN CHLOROFORM.

By JOHN MORGAN, M.D., F.R.C.S.I.,

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THE question of the safety of ether as an agent in producing anaesthesia in surgical operations is one which may justly be considered of importance; and the claims which have been advanced on its behalf, both on the Continent and in America, where it has held its place for over a quarter of a century, deserve the attention of practitioners, who may have had reason, from practical experience, to distrust chloroform, or who may have found difficulty in overcoming the distrust which patients naturally feel in an agent which is accompanied by danger, and which has often instanced its subtle power by causing death under the most favourable circumstances, and where the greatest care had been taken to guard against any mischance. The reports which have been given even during the last week are particularly suggestive (BRITISH MEDICAL JOURNAL, October 5th), and must go far in condemnation of chloroform, and in increasing the nervousness as to its use both with the public and the practitioner, which is daily becoming more marked. We find that in one case, a lady aged 70, presumably healthy for her age, died "when very little chloroform had been used"; another case was that of a man (a hard drinker) aged 34, with whom three drachms of chloroform had been used; and *post mortem* examination revealed so little to explain death, that the question is fairly asked, "How are we to know beforehand that a patient cannot, without dan-

ger, take chloroform?" for this man, though a hard drinker, had been previously examined, but there were no physical signs to enable any disease of the heart or lungs to be discovered. The uncertainty of prognosis is again instanced by a third case of a boy, where the first symptom of danger was cessation of the pulse. We have thus in the three stages of life—youth, middle age, and old age—instances of the subtle and fatal influence of chloroform as an anæsthetic. When to these we add the ratio of one death a week, as the death-rate accorded to chloroform accidents in England, the sum is one well calculated to excite serious apprehension, and should lead us to question at least its safety. It would be "sad, and indeed not possible, that we should come to regard chloroform deaths with apathy or indifference, as events of course". Admitting that the deaths as reported from chloroform are approximately correct, let any surgeon in practice add to these the hair-breadth escapes and the dangerous syncopes he has seen under its influence, which but for timely and most energetic interference would almost to a certainty have terminated fatally, and but barely give him room to congratulate himself not so much on the success of the operation, as on another escape from chloroform danger. We may frankly admit that there is ample room for distrust in an agent which, notwithstanding its virtues, so seriously and so frequently betrays us.

The question naturally arises, Are other anæsthetics equally dangerous? In the *Odonto-Chirurgical Society's Reports*, p. 401, a death from bichloride of methylene is reported, where the heart had been previously carefully examined, yet at the end of two or three minutes danger appeared; notwithstanding efforts to restore the patient being used for three-quarters of an hour, they were useless. Nitrous oxide, even for those who can endure the aspect and condition of the patient while under its influence, is admittedly unsuited for anything of a prolonged operation.

If the force of statistics be of any value, ether, beyond question, is the agent which presents the most powerful claims, and must obtain our confidence as the safest anæsthetic. The reports given at the Medical Society of Virginia during this session are conclusive: by combining American and British statistics, the result is found to be as follows.

Agent employed.	Deaths.	Inhalations.
Ether	4 to	92,815, or 1 in 23,204
Chloroform	53 to	152,260, or 1 in 2,873
Mixture of Chloroform and Ether ...	2 to	11,176, or 1 in 5,588
Bichloride of Methylene	2 to	10,000, or 1 in 5,000

It is thus proved statistically that chloroform is eight times as dangerous as ether, twice as dangerous as a mixture of chloroform and ether, and, as far as experience goes, it is more dangerous than bichloride of methylene; in fact, chloroform is the most dangerous of all the anæsthetic agents in use. If statistics are of any value, these should be startling and impressive ones. The report of the London Chloroform Committee states the result of careful investigation, that "ether is less dangerous than chloroform," and that "with every care and the most exact dilution of the chloroform vapour, the state of insensibility may pass in a few moments into one of imminent death;" and the latest surgical work from America advocates ether as the most suitable anæsthetic. I have myself made numerous comparative observations on animals, and found that ether was much superior in safety; and from many observations on patients, I am bound to pronounce in its favour. I have used it at all ages, from 3 and 4 years to 71. I have kept patients under its influence for an hour. I have used it with patients where chloroform had been used before and was in future forbidden, owing to the alarming symptoms which it caused; in one instance, four hours were occupied in obtaining restoration, yet in none of these was there the slightest inconvenience with ether. I have used it in cases where chloroform on former occasions produced a most violent spasmodic stage; with ether there was nothing of the kind to be seen. From amputation to the most delicate operations on the eye, or where so short a period was required as necessary in dentistry to such tedious operations as for vesico-vaginal fistula, ether has proved itself both most convenient and efficient, while it has the great recommendation of being proved to be the *safest* of all anæsthetic agents.

The arguments which have been urged against its use have been those only of its being inconvenient. I believe that these inconveniences have arisen from want of a perfect means of application, and the rough way in which it has been administered, by pouring it on a cloth or on a sponge, and either allowing the air to have free access, enclosing the face, more or less, with a cone of pasteboard. The nitrous oxide gas is found to be most efficient when air is excluded. This rule, I believe, also to apply to ether. The more freely the ethereal vapour is exposed to the patient the better; the more perfect will be the etherisation, but not, as with nitrous oxide, where the symptoms of apnœa are, more or

less, rapidly and painfully marked, the insensibility will gradually and equally supervene. For this purpose, I have designed an inhaler which is so constructed that by means of an elastic diaphragm with which the instrument is furnished, and which accommodates itself to each respiration, the patient can re-breathe the vapour, for the diffusion of which the inhaler has an internal arrangement. A flexible tube, furnished with a water-cushioned mouthpiece, conveys the vapour to the patient. I have found this inhaler most efficient. I never had a failure or, I may say, an inconvenience. Four ounces of ether will usually be ample to procure an anæsthesia of twenty minutes' duration. It is to be remembered that the influence is not so rapid in taking effect as with chloroform; from four to eight minutes is usually required, it may be a little sooner and it may be a little longer; the patient falls into a deep sleep and may snore. The mouthpiece may then be removed for a little, and with returning sensibility be again applied. As for sickness of stomach, I have not seen it, if the patient be not allowed to take anything solid for three hours or so before operation; and, as for spasm, it is far less usual, and certainly less marked than with chloroform. I allude to cases where the inhaler is used. Should air be freely admitted, I have found by experience that spasm, excitement, and sickness of stomach are proportionately more frequent. Persuaded as I am by experience in the free application of ether by the inhaler, I would urge a calm and dispassionate inquiry by practical surgeons into the merits of ether. May we not be wedded to an agent which is accompanied unquestionably with danger to the patient, and which too frequently oppresses the surgeon with responsibility, more than the operation in which he is about to engage?

OBSTETRIC MEMORANDA.

CONVULSIONS DURING THE REMOVAL OF THE PLACENTA: DEATH.

As death occurring from convulsions during the removal of the placenta is somewhat rare, I am induced to send the following notes to the JOURNAL.

Mrs. W., aged 24, had been confined three times in two years. The birth of her first child had been followed by a severe attack of rheumatic fever with endocarditis; and, although her recovery was slow and tedious, she subsequently enjoyed good health. Her second child was born eleven months after the first. In this case, the placenta was adherent at a point near the fundus, requiring manual interference for its removal. Twelve months after this, on November 27th, 1872, I was called in to attend her in labour with her third child. Upon my arrival, at the house, I found the child had been born about ten minutes. The placenta still remained. She was quite cheerful; her pulse was regular and moderately firm; there was no more than the usual amount of hæmorrhage; and nothing at all in her condition to give me the least anxiety, or to lead me to anticipate what was about to happen. After waiting ten minutes, and finding gentle pressure on the abdomen and traction at the cord insufficient to dislodge the placenta, I introduced my hand for the purpose of its removal. As soon as the hand was in the uterus, the patient was suddenly seized with convulsions, accompanied with stertorous breathing, and died in less than five minutes.

Dr. Ramsbotham refers to similar cases of convulsions followed by death whilst removing the placenta, and considers them due to irritation propagated to the brain through the agency of the nervous system. As no *post mortem* examination was permitted in this case, I am unable to state definitely the cause of death; but I am inclined to believe, from the symptoms exhibited, that it resulted from embolism of the pulmonary artery. It is possible that slight structural thickening of the valves or of the columnæ carneæ, the result of the endocarditis that occurred after the first confinement, may have tended to promote the formation of a thrombus.

A. BROOKE GEORGE, L.R.C.P. Edin.

Whitchurch, Salop, October 1872.

THE DIAGNOSIS OF BLENNORRHOÏA IN THE FEMALE.—Professor Kuss of Strasbourg, in examining Lock cases, was accustomed to collect with a glass rod, a little of the secretion of the vagina and cervix, at the speculum examination, and deposit it on little numbered squares of glass. These were subsequently examined under the microscope; if the liquid showed pus-globules, the patient was detained as gonorrhœal; if only vaginal cells, she was declared free from specific disease. (*France Médicale*, September 21st.)