whether the duodenum is or is not short-circuited out of the alimentary canal. The cause must be common to both obstructed and non-obstructed cases, and is probably to be found in the regurgitation of alkaline bile and pancreatic juice into the stomach and in the consequent reduction of gastric acidity, together with the inhibition of the rennin.

4. That in cases of recurrent intractable duodenal or gastric ulceration, an operation is indicated which will ensure the complete loss of the acid reaction of the stomach, while the benefit at present conferred in ulceration by gastro-enterostomy is due to the partial loss of that reaction. That such an operation would consist in closing the proximal end of the bowel and implanting the distal directly into the stomach. That where gastro-enterostomy is performed the opening should be near the cardiac end of the stomach, and that the anastomosis should be simple, not Y-shaped, nor with enter-enterostomy.

5. That the complete digestion of fats on a mixed diet is due to the specific stimulating effect on the pancreas of a hormone produced by the fats themselves.

6. A case of malignant pyloric obstruction, after partial gastrectomy and posterior gastro-jejunostomy, showed complete power of dealing with fats.

Finally, I take the opportunity of pleading the laborious nature of the experiments carried out as an excuse for their small number, and of thanking the physicians and surgeons under whose care the patients were at Guy's Hospital, and Mr. Swan at the Cancer Hospital, for their kindness in so readily granting facilities for work which can have no claim to be considered of the highest practical importance.

NOTE.

In an address delivered at the annual meeting of the American Medical Association, at Atlantic City, U.S.A., and published in the *Lancet* for September 21st, 1907, Mr. H. J. Paterson states that he has found little diminution in the power of digesting fat in 4 patients upon whom he had performed gastro-jejunostomy, and who were placed upon a milk diet. Details as to the method adopted and the amount of milk given are wanting. The fat absorption, taking the average of 4 cases, is stated to have been only 1.17 below the normal. The present analyses were completed before the publication of this paper.

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ETHER ANAESTHESIA BY THE OPEN METHOD.

By H. BELLAMY GARDNER, M.R.C.S., L.R.C.P. LOND.,
LATE INSTRUCTOR IN ANAESTHETICS AT CHARING CROSS HOSPITAL.

SINCE the year 1876, when Mr. J. L. Clover invented his portable gas and ether apparatus, it has until recently been the custom in England to administer the vapour of ether as a general anaesthetic by means of a closed india rubber bag. This method produces a very rapid insensibility; the total amount of ether evaporated averages only 6 fl. oz. an hour, and little vapour escapes into the surrounding atmosphere. Its disadvantages are that the partial deprivation of air and rebreathing of expired products from the bag tend to produce:

1. Duskiness of the countenance and oozing of venous blood from the cut surfaces of the operation wound.
2. Considerable secretion of mucus from the membranes of the air passages.
3. Laboured breathing, with strong movement of the abdominal walls.
4. After-sickness in 75 per cent. of the cases.

These factors render the smooth conduct of ether anaesthesia with a bag inhaler more difficult than that of chloroform, with the result that many practitioners

do not attempt its use in private practice, and that chloroform is also frequently resorted to by specialists when complete tranquillity is desired.

The open method of administering ether has been used in America for several years, and the procedure which I now adopt, after a series of careful trials and experiments with various materials, consists in pouring ether upon a wire-framed mask covered with ten layers of white absorbent gauze such as is used for surgical dressings. The mask, which may be of the Schimmelbusch pattern, or constructed according to the author's special design shown in Fig. 1, is allowed to rest lightly upon a freshly-made gauze face-pad consisting of several layers of the same gauze made into a roll 14 in. long and 1 in. thick. The free ends of the roll are crossed and tied

Fig. 1.

together with a short piece of gauze or tape, as shown in Fig. 2, before the mask is applied. An 8-oz. medicine bottle, fitted with the double-tubed stopper illustrated in Fig. 3, is well adapted for the supply of ether, which can be poured from the end of either tube at a rate controlled by the finger held upon the other. To diminish the supply still further the bottle may be held somewhat upon its side, when a small stream of separate drops falls from the tube orifice. A larger stock of ether must also be at hand, as in some cases from 12 to 16 oz.

may be required for a long operation.

Fig. 2.

THE ADMINISTRATION.

The patient being in the supine position is first told to close the eyes, and the gauze face-pad is then loosely laid upon the face forming an oval, which covers the closed eyelids and encircles the mouth and nose. The dry ether mask is then superimposed, and the patient is told to breathe regularly and slowly in and out through the mouth. A few drops of ether are then allowed to fall upon the lower portion of the mask opposite to the mouth; and whilst verbally encouraging the patient to continue this form of breathing, the drops of ether are steadily continued so as to keep the lower half of the gauze moist to the touch but not wet enough to overflow. It is a good plan to keep talking steadily to the patient, instructing him how to breathe and describing the sensations he will experience until he drops off to sleep, so that the sound of the voice may guide and control him while he remains conscious.

The taste of ether when presented in this manner is not objected to by the majority of patients, because it is too weak to be pungent. There is hardly any excitement or struggling except in alcoholic subjects, for whom it should not be used. The only movement which may usually be anticipated is a tendency to slowly raise the head and sit up, which is often witnessed also during the induction with C_2E_2 mixture in adults. This need not be restrained, as it only lasts for a minute or so and if the ether be steadily continued the patient will slowly sink back upon the pillows in the third stage of anaesthesia. The time taken to induce this condition is, on the average, between six and seven minutes. As a rule, when slight stertor

Fig. 3.

begins to arise the anaesthetist's troubles are over, but movement of the patient by commencing to wheel the couch along or to prepare the abdomen for operation at this moment is apt to induce vomiting, so that the ether should be continued a little longer before doing either.

TYPE OF ANAESTHESIA.

The remarkable difference in the type of anaesthesia when compared with that of the enclosed bag method is now apparent. The amount of mucus secreted in the mouth and fauces, trachea, and bronchi, is generally much less. There seems to be no tendency to coughing, retching, or laboured breathing; the depth of respiration is decidedly less in degree, and sudden changes in its type are rare. The colour of the face is pink, unless surgical shock or haemorrhage take place. The pulse-rate is, as a rule, about 80 to the minute, and its volume full, whilst the blood pressure is well maintained.

There is no oozing of venous blood from the operation wound nor congestion of the capillary vessels. The musculature becomes completely relaxed, and reflex laryngeal spasm and disturbances of respiration caused by surgical stimuli are less marked than under any other anaesthetic. Abdominal movement is not heaving in character.

AFTER-EFFECTS.

My experience is that after-sickness and other bad effects, such as headache and taste of ether, are remarkably reduced; the patient being frequently quite undisturbed by any such sensations. This is corroborated by Drs. Weland and Osgood of Boston, Mass., who, writing on gauze ether,¹ state that the occurrence of post-anaesthetic vomiting is reduced to 32½ per cent., and transient acetonaemia to 26 per cent. of the cases. Profuse perspiration occurs in many patients both during and after operation, and therefore, besides blanket clothing, the temperature of the operating room and bedroom should be maintained above 60° F. I have found by experiment that the temperature of the air within the mask does not sink below 70° F.

A few details may now be given from the experience of Miss Alice Magaw, anaesthetist to Dr. W. J. Mayo at St. Mary's Hospital, Rochester, Minn., which are recounted by her in "A Review of over 14,000 Surgical Anaesthesias":²

A much deeper narcosis is required to start an operation or to make the incision than later on when the operation is in progress.

Never bid a patient to "breathe deep," for in so doing a feeling of suffocation is sure to follow and the patient is also apt to struggle.

During the operation, as soon as the patient begins to get control of the jaw, more complete narcosis is required.

Formerly operations for exophthalmic goitre were looked upon with a great deal of dread on account of the anaesthetic. We have found these cases, when properly managed and the ether given by the drop method, were as good subjects as any other class of cases of the same gravity.

One-sixth of a grain of morphine and ½ grain of atropine are administered to avoid tracheal mucus thirty minutes before operation.

The mask and gauze can be boiled, and the latter used again for further cases if desired. Instead of a gauze face-pad I experimented with a rubber rim to the open mask, but discovered that its perfect fitting, after the lapse of some minutes, produced the laboured breathing which is seen with the bag inhaler. This does not occur with a loose gauze pad, though it forms sufficient protection from the undue escape of ether vapour, which is 2½ times heavier than air, and otherwise sinks away and is lost.

No open flame nor cautery must be brought within 3 ft. of the evaporating ether, which is inflammable.

One drawback to the use of the open method is the quantity of ether which passes into the atmosphere; but the amount used is much reduced after a little experience when with more faith less ether is found to be necessary. The difference of the method does not reduce the danger of the occurrence of acute bronchitis and pneumonia in patients with catarrh, chronic bronchitis, or emphysema, for whom ether is unsuitable, nor should it be continued if mucous rales become audible during operations which, by reason of after-pain, will prevent the patient from coughing to clear out the bronchi, such as those upon the stomach and gall bladder.

Alcoholics, malarial subjects, and those with a family

history of insanity take chloroform better than ether, and will prove unsuitable patients for this method.

The open mask may be used after anaesthesia has been induced with nitrous oxide and ether or the C.E. mixture if preferred, but the simplicity, aseptis, and perfection of the method *ab initio* leave little to be desired.

Messrs. Allen and Hanburys, of Wigmore Street, W., have rendered me assistance in preparing models for the open mask and bottle-stopper, for which I am greatly indebted to them.

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THE CONVEYANCE OF WHOOPING-COUGH FROM MAN TO ANIMALS BY DIRECT EXPERIMENT.

By HUGH A. MACEWEN, M.B., CH.B.,

D.P.H.LOND. AND CAMB.,

LATE RESIDENT ASSISTANT PHYSICIAN, BELVIDERE FEVER HOSPITAL,
GLASGOW.

THE etiology of whooping-cough has been the object of much research, and many and various have been the theories advanced on the subject. Of late years, however, the belief has been gaining ground that it is bacterial in origin.

Koplic, by making cultures from the sputum on solidified hydrocele fluid, obtained pure growths of a small bacillus with rounded ends which he claimed to be the specific organism. Jochmann and Krause discovered a small bacillus with rounded ends, very similar to the organism described by Eppendorf as the *Bacillus pertussis*. Vincenzi also claims to have isolated a bacillus which much resembles or is identical with that of Eppendorf. Mayennis, on the other hand, believes that the disease is due to a bacillus which finds a nidus on the Schneiderian membrane of the nose. None of these observers have, however, been able to prove that the organisms isolated by them are the true cause of the disease, and thus its precise etiology still remains obscure.

With the object of trying to throw light on certain aspects of this question, feeding experiments on animals were instituted, and it is for the purpose of calling attention to one of these experiments, performed in Belvidere Hospital, Glasgow, that the present article is written.

A full-grown and in every way healthy cat was placed in confinement in a building far removed from the wards in which whooping-cough patients were isolated. Sputum and vomited material were then collected from selected cases of typical whooping-cough without bronchopneumonia or other complications. These substances were mixed with milk and administered to the cat, which took to the new diet with a fair degree of relish. For seven days this emulsion of sputum, vomited material, and milk formed the animal's sole source of nutriment. At the end of that time it was put upon ordinary milk once more.

After about fourteen to seventeen days, it was noted that the cat was getting into a languid condition; it lay at the back of its cage, and took little note of what went on around it. It had little appetite; when milk was placed before it, it would lap a little without any of the zest which characterized its attitude towards food at the commencement of its confinement.

About a month after the beginning of the experiment it was noted that the animal had a choky cough, which was always followed by vomiting. Some time later it developed a spasmodic cough, accompanied by a well-marked whoop, which even persons unacquainted with the nature of the experiment at once pronounced to be whooping-cough. When these spasms came on, the animal, rising and clinging to the bottom of the cage with its claws, coughed and whooped in a manner which left no doubt as to the nature of its complaint.

The conclusions to be drawn from the above experiment would seem to be:

1. That whooping-cough is beyond doubt an infectious disease.
2. That the specific virus is contained in the sputum or vomited material or both.