introduction of the five-day course of atebtrin; patients were usually given twelve tablets of plasmoquine co. during the first week, and two tablets during each of the remaining weeks, the usual quantity of quinine administered daily being twenty grains. Results of this treatment were not to be compared with those obtained from the atebtrin course, as may be gathered from the number of Q.C. references on my list. In my experience the size of a palpable spleen has diminished at about the same rate, whether the malaria has been treated with quinine or by atebtrin. Quinine in large doses (grains xx stat.) brought about relief of symptoms far quicker than did atebtrin in orthodox doses.

The only occasion on which I have injected atebtrin was in the case of an ill-nourished East Indian girl, aged 3, with convulsions. The prognosis seemed hopeless, and I was surprised that she recovered, as my mortality with such cases treated by quinine injections is very high. Case 13 was apparently one of relapse; a careful examination of the surroundings of this patient's dwelling place failed to discover any source of infection.

Each of these patients appeared, and believed himself, to be cured as the result of this treatment; observation over several more months will be necessary to establish the actuality of such "cure." No follow-up treatment has been carried out, except to administer cod-liver oil to a small percentage of these cases: all patients were requested to return immediately to the dispensary in the event of recurrence of fever.

The ages of the patients ranged from under 3 years to over 40, the majority being between 20 and 30 years old. Thirty-seven were males and thirteen females. Europeans numbered six, negroes twenty-nine, and East Indians fifteen. Benign tertian malaria was present in twenty-four cases, malignant tertian in twenty-four, mixed benign and malignant in one, and quartan in one. The course of treatment included: (1) haustus mag. sulph. $\bar{c}$ sod. bic.; (2) quinine with potassium bromide in cases with acute symptoms; (3) fifteen tablets of atebtrin (one t.d.s.) in cases of benign tertian; and (4) fifteen tablets of atebtrin and fifteen of plasmoquine co. (of each, one t.d.s.) in cases of malignant tertian and quartan. At the conclusion of the treatment all bloods were negative, except in Case 42, which had been treated for benign tertian and was found to be a case of malignant tertian (rings) when examined after treatment with atebtrin only. There was only one return case.

CONCLUSIONS

1. That the atebtrin, and atebtrin combined with plasmoquine co., treatment of malaria (in Trinidad) is superior to its predecessors.
2. That atebtrin is an effective preparation which can safely be handed out to patients of moderate intelligence.
3. That the dosage of plasmoquine co. mentioned in this paper is sufficient, and that the advice of the manufacturers—that the administration of plasmoquine be carried out under medical supervision—is of very great importance.

These notes were presented at a meeting of the Southern Division of the Trinidad and Tobago Branch of the British Medical Association, and I am grateful to members for their advice and kindly criticisms, which are responsible for the form of the present report. I am also indebted to the staff of the Apex Oilfields Company for their assistance in securing regular treatment.

The annual report of the Registrar of Births and Deaths, Federated Malay States, draws attention to the fact that throughout 1932 no deaths were recorded from small-pox, cholera, or plague. Eleven deaths were, however, caused by meningococcal meningitis as against six in 1931, and there were forty-six deaths from diphtheria as compared with twenty-nine. It is possible, the report adds, that more exact diagnosis is the explanation of the increased numbers recorded.

THE "RECOVERY PRINCIPLE" IN GAS-OXYGEN ANAESTHESIA

A "CLOSED" SYSTEM

BY

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The principle of "gas recovery" as applied to gas-oxygen anaesthesia is a development about which a good deal is being heard at present. Several publications have appeared in journals and other literature under various titles which, however, all deal with the same idea—namely, the use of means whereby general anaesthesia may be maintained by the constant re-use of a limited amount of anaesthetic gas. It may be helpful to define the principle more exactly.

By "recovery principle"—the term to be used throughout—is meant the continuous rebreathing of a relatively small fixed volume of anaesthetic gas which is constantly maintained in a respirable and life-supporting condition. This definition implies a completely "closed" system, consisting of the apparatus and the respiratory organs of the patient with whom the apparatus is connected: it also implies the removal by suitable means of the gaseous waste products of the patient, and the supply to him of an adequate amount of oxygen to sustain life. This idea of recovery of anaesthetic gas is not new, protection by patent having been sought by German and American experimenters from 1926 onwards. Others, in all probability, have had the idea in mind before that, as the chemical basis of the principle has been known for a considerable time. Within the last two or three years British anaesthetists have exhibited an increasing interest in this matter, and have produced experimental machines of remarkable capabilities, but, so far, the possibilities of this method of anaesthesia do not appear to have been sufficiently realized in practice to justify the permanent adoption of the principle by anaesthetists. That the recovery principle has come to stay there can be little doubt, but it has to be developed along lines different from those generally adopted in existing machines.

On looking into the various inventions in this particular field one is struck with the almost complete identity of thought exhibited by the several inventors (including the writer in his earlier experiments). This problem has, in all cases, been approached from an analytical standpoint, which reasons and visualizes the several functions of the necessary apparatus as occurring in a unidirectional cycle, the rhythm of which is governed by the act of respiration. It is therefore found that all recovery machines, described or in use, are constructed according to this point of view, and are therefore very similar in their working and general design. From experience the writer is able to state that this point of view, and the method of construction based upon it, while it works reasonably well, is not the most efficient one, and consequently enough cannot be made of the recovery principle to justify its complete acceptance with confidence. Practical experience with four machines constructed on this scheme of breathing in a circle showed the inherent defects of the method, and it ultimately became apparent that the respiratory circle with its double tubes and directional valves was quite unnecessary. Much better results were later obtained from machines worked by simple to-and-fro breathing through a single tube, since by this arrangement the breath has to pass through the absorbing chamber on *inspiration* as well as on *expiration*. The same, of course, applies to the ether chamber when it is in use. This simple but important change, by thus increasing efficiency, led to greatly improved construction,

and the machine now made according to this arrangement is known as "anaesthetor M 7."

THE APPARATUS DESCRIBED

In this machine the difficulties attendant on the application of the recovery principle have been dealt with rather differently from those occurring with the usual methods described.

FIG. 1.—Diagrammatic section of mouth parts, showing throat tube in position.

Concerning the problem of effecting the closure of the gaseous system (upon which the recovery principle primarily depends) the writer found at the outset that no masking appliance or tracheal tube could do this effectively in all cases. A special tube for introduction into the patient's throat, after the production of unconsciousness by a mask, was designed and tried with success. This tube consists of a very flexible, rustless steel, oval wire coil, over which is drawn a rubber cover that has a small tyre at its free end. This tyre is inflatable from outside the mouth after the tube has been placed in position in the throat. With this breathing tube correctly inserted, and the tyre making close peripheral contact with the pharyngeal wall behind the tongue, the gaseous system is effectively closed. Further advantages are also obtained by the use of this tube. A perfect airway is always provided in any position in which the patient may be placed: no saliva or foreign matter can escape past the tyre into the lower air passages: the head, face, and mouth are accessible for surgical and dental

FIG. 2.—Diagrammatic section of anaesthetor.

work, and positive pressure to individual limits—say, 20 mm. Hg—is easily maintained without leakage. Such pressure is, however, used with discretion. This breathing tube provides the key to the successful application of the recovery principle, and it is an essential element of recovery machines.

The method of absorbing the exhaled CO_2 is also of interest. In the experimental stages the writer was

always encouraged to use granular soda-lime absorbent, but it was found that the dry absorbents were not best suited to anaesthetic conditions where one had, in many cases, to deal with very low respiratory power. Other objections became evident, such as the difficulty of uniform packing, and consequent irregularity in the track of the breath as shown by the irregular colour change of the absorbent. What was of importance also was the

FIG. 3.—Portable pattern anaesthetor.

difficulty of being able to determine the amount of work that could be expected from a canister that had been previously used. After trial and consideration, the solid absorbents were abandoned in favour of a strong solution of caustic soda. Arrangements were made in the machine to effect absorption of CO_2 at a very low resistance, and also for the handling of such solutions without difficulty

FIG. 4.—Hospital unit anaesthetor.

or danger. This method has proved very successful. The chemical avidity for CO_2 of such a solution is greater than with a solid absorbent; the absorption is uniform, and a simple method has been worked out to give a good idea as to how much absorption any solution is capable of after having been previously used. This is particularly necessary in hospital practice, where the machine may be taken in hand by different anaesthetists.

With these two inherent difficulties dealt with in this way, and construction in accordance with to-and-fro breathing, the machine becomes remarkably simple, light, and compact, with essential parts similar to those of other instruments. In addition, however, there is a level and levelling screws; for it is essential that the machine be level when in use for the proper absorption of the CO₂. The supply of gases is by simple fine adjustment valves through ordinary sight-feeds. There are no special mixing arrangements required, as the nitrous oxide atmosphere in the machine is absolute, just as is the nitrogen of the air which it replaces. Oxygen is added at the metabolic rate, and delivered almost at the patient's mouth, producing immediate effect.

ADVANTAGES

In practice the "anaesthetor" is simple to work, is most satisfactory from the clinical standpoint, and operates with the highest degree of economy—three gallons or less of anaesthetic gas per individual case, irrespective of duration. Owing to its simplicity of construction, complete dismantling for purposes of cleaning and sterilizing is a matter of only a few minutes' work, and there is no part which cannot be completely sterilized, even to the rubber throat tubes. The rubber of these tubes is of such make that it can be judiciously boiled without damage. Such are the chief advantages that the recovery principle has to offer through "anaesthetor M 7." Space forbids an extended account of its performances, which may be summed up as showing great progress in (1) the management of general anaesthesia; (2) the provision of surgical anaesthetic conditions; (3) the recovery of the patient from the anaesthetic; and (4)—not unimportant—working costs of a previously unheard-of low degree. The apparatus is arranged as a unit suitable for hospital conditions, carrying one 40 cubic foot (or smaller size) cylinder of oxygen and two angle-valved cylinders of nitrous oxide, either 100 or 200 gallon size. The unit is also fitted with "Tycos" blood-pressure-registering equipment. The machine is also arranged as a portable apparatus weighing, with metal case, about twenty-eight pounds. A separate cylinder carrier may be used in conjunction with the machine, and it accommodates very compactly three angle-valve cylinders of any capacity up to the 100 gallon (N₂O) size. Cylinder weight will be reducible in the future when the firms who fill them are in a position to accept the light-weight cylinders unconditionally.

In the tenth annual report of the Ella Sachs Plotz Foundation for the Advancement of Scientific Investigation it is announced that twenty-one grants were made in 1933, one being a continued annual grant. Twelve of the new grants were made to scientists outside the United States, among whom was Dr. H. A. Krebs of Cambridge, who received assistance for the continuation of studies on the breakdown of protein in animals and of the metabolism involved in the action of insulin. Another beneficiary was the Academic Assistance Council of London. In the ten years of its existence the Foundation has made 200 grants, researches being favoured which were directed towards the solution of problems in medicine or surgery, or in branches of science relating thereto. Applications for grants to be held during the year 1934-5 must be forwarded to Dr. J. C. Aub, Collis P. Huntington Memorial Hospital, 695, Huntington Avenue, Boston, Massachusetts, to reach him before the end of April. They must state definitely the qualifications of the investigator, the character of the proposed research, the amount of the grant requested, and the specific way in which the money would be expended. It is advised also that letters of recommendation from the directors of laboratories or clinics where the work is being done should accompany the applications. The maximum size of the grants will usually be less than 500 dollars.

THE MANAGEMENT OF BREAST-FEEDING IN GENERAL PRACTICE*

BY

H. R. YOUNGMAN, M.D.CAMB.

Failure to feed at the breast is still only too common. It will be so as long as this subject is enveloped in the public mind by a cloud of ignorance, evil tradition, and old wives' tales. It is the duty of the general practitioner to lose no opportunity of dispelling this cloud. This paper is limited to the management of breast-feeding in normal cases and slight variations from the normal. Since at least 95 per cent. of cases start normal, it should not be difficult to keep them within these limits.

ANTE-NATAL CARE

It has been stated that a woman's confidence in her natural power to nurse a baby can be inspired "by an exaggerated air of optimism on the part of those about her." Personally I can imagine nothing more calculated to put her off. Rather, the power to give confidence depends on one's gifts of sympathy and tact. But most of all, on one's own confidence that if difficulties do arise one will be able to put them right. The breasts should be examined when the patient is first seen. She should be instructed to brush the nipples with a soft brush and toilet soap daily when washing for the last two months, and to sponge the breasts with cold water before drying them. A warning should be given against any application containing spirit. If there is any retraction of the nipples she should be shown how to draw them out daily and roll them between the finger and thumb with a little oil as lubricant. In extreme retraction it may be necessary to apply a breast pump daily for a time.

PHYSIOLOGY AND ITS APPLICATIONS

The normal stimulus which maintains the secretion of the breast is regular sucking. The response varies with the degree and, up to a point, the frequency of emptying. The normal gain in weight is shown by the dotted curve in Fig. 1. A weight curve on this chart is much more useful than a written record of ages and weights. Every normal child will be found to keep very nearly parallel to this average curve, above or below it according to its weight at birth. A child whose curve does not ascend as steeply as the average for its age is to be regarded as "underweight," and will soon show signs of malnutrition if left alone. The weight at any age taken by itself is no guide to the child's condition. To take an extreme example, in Fig. 1 the child A is normal at ten weeks while the heavier child B is obviously "underweight." In each of these curves it should be noted that the infant gained weight faster than normal for a time after a set-back, tending to regain its former relation to the average. In treating underweight babies one has to aim at this result. For further examples see Fig. 2.

The quantity of milk required for normal progress is indicated in the following table:

Breast-milk Requirements: Normal Infants

Age in Months	Normal Weekly Gain of Weight in Ounces	Milk required Daily per 1 lb. Body Weight in Ounces
0	7	2½
4	5½	2¼
8	4	2

Underweight infants require up to half as much again as normal infants of the same weight and age.

* Part of a paper read to the Cambridge Medical Society.