level if pace accelerated, and note nature of distress produced.

(2) Compare amount of effort possible without distress: (a) Before and after food; (b) on warm and on cold day, and note nature of distress produced.

(3) If no distress complained of on effort, note if there is any diminution in capacity for work.

(4) Endeavour to estimate, for comparison, the patient's capacity for effort while in good health.

(5) Note whether present capacity is increasing, stationary, or diminishing.

The Response to Effort.

In addition to other symptoms of disease, failure of health is frequently indicated by a limitation, in one direction or another, of the capacity for effort. Breathlessness and pain are the two symptoms which appear in patients as the first evidence of cardiac inefficiency. Exhaustion, palpitation, and giddiness, on the other hand, indicate, as a rule, some extracardiac cause; where they occur alone—apart from breathlessness or præcordial pain—the efficiency of the myocardium is not at fault. The organ whose efficiency is impaired can be ascertained in any case only by consideration of the associated phenomena present. The object of the "Response to effort sheet" is to ensure the recording of such associated phenomena as we at present consider of use in this direction.

The impossibility of fixing a standard of effort common to all patients was early realised, and the individual standard was adopted—i.e., the amount of effort that could be undertaken by the individual while in health.

This consideration is well illustrated by the case of a blacksmith who complained of breathlessness on climbing a hill or a stair, while he felt no distress on swinging his hammer in his daily work.

It is, moreover, true that the capacity of each organ to respond to effort must be the ultimate test of its efficiency. The inefficient kidney, for example, in its advanced stages produces symptoms forming a definite clinical picture. One must suppose that these symptoms represent the terminal phase of a gradual development; and that the accurate observation of such cases in their early stages would elicit a definite symptomatology characteristic of the onset of inefficiency. No doubt each organ reacts first to some particular need of the organism, and it lies with the clinician to determine that need and the symptoms which indicate the failure of the organ to meet it.

As all organs have periods of quiescence and periods of activity it is manifest that the first sign of failure will be a limitation of the field of response to effort. Only by prolonged experience can we acquire a knowledge of the details essential for a proper inquiry into the significance of limitation of effort in the case of each organ. This sheet, therefore, even to a greater extent than the others, is provisional, and the directions by which it is accompanied serve to emphasise this.

Methods Employed by the Institute for Securing and Investigating Material.

Each practitioner on the staff has, in the Institute, a private room which is reserved for two hours in the day for the examination of research cases. During the rest of the day he is at liberty to use it as his private consulting-room. He selects cases suitable for research from his private practice and investigates them during his research hours. Each member of staff is at liberty to consult any of his colleagues at any stage in the case; in order that the utmost benefit may be derived from this privilege, each member of the staff makes himself specially familiar with the literature of one particular branch of clinical medicine—cardiology, neurology, and so on. The necessary chemical, bacteriological, hæmatological, and radiological investigations are carried out by the special departments, and with each specimen or case full clinical notes are supplied to the special department. When the notes of each case are completed they are read at a full meeting of staff and discussed in detail. Indices are kept of all symptoms recorded, and of the leading symptom and provisional

diagnosis of each case, and arrangements are made to ensure the return of the patient at regular intervals. Two full copies of each case are made and filed, one for the use of any member who is interested in any particular case, and the other for permanent preservation in a fireproof safe.

Finally each case is considered in detail by a special committee, whose duty it is to classify and tabulate the findings, and to see that all cases are utilised for special investigations. If this committee finds that a case taken by one member of staff has some bearing on special work in charge of another it is its duty to inform the latter of the fact. This committee also keeps a note of the date upon which each patient should return; and at the beginning of each month a list is sent to each clinician of the patients whom he should arrange to see during that month. In addition to the regular research work and the weekly reading of cases, one afternoon in each week is devoted to the discussion of some subject of interest which is chosen by the clinical staff and is introduced by the member who happens to be specially interested in it.

A NEW METHOD OF INVESTIGATING GASTRO-INTESTINAL SECRETION.

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THE purpose of the present communication is to draw attention to a new method of investigating the secretory activity of the alimentary tract in health and disease. By taking samples of the alveolar air at intervals after a meal, the writer¹ was able to demonstrate that the tension of carbon dioxide undergoes certain definite changes in response to the amount of secretion poured out (a) by the stomach, (b) by lower portions of the alimentary tract. In later work, in conjunction with Dr. T. Izod Bennett,² it was shown that in normal individuals of varying type the curve of alveolar CO₂ tension so obtained corresponded closely with the curve of secretion of gastric HCl. The variations in CO₂ tension may be explained in the following way: when acid is removed from the blood during gastric secretion the reaction of the blood tends to shift to the alkaline side. This shifting is prevented by retention of the volatile acid, CO₂, the tension of which rises in the blood, and hence in the alveolar air. Later, when the alkaline intestinal and pancreatic secretions are poured out, the reaction of the blood tends to shift to the acid side, and hence acid in the form of CO₂ must be eliminated. This is brought about by a lowering of the CO₂ tension in the blood, and therefore in the alveolar air.

This method has now been applied to a number of pathological cases, examples of which are given. The figure shows three curves obtained (a) from a normal individual, (b) from a case of pyloric carcinoma, and (c) from a patient with pyloric ulcer, respectively. In the curve marked normal it will be seen that, after a meal, the tension rose 4.5 mm., returning to its previous value in 1½ hours, then fell 2 mm., and finally returned to its original level in 2½ hours. After this it remained constant. The pyloric ulcer curve shows a greater and more prolonged rise (5.5 mm. lasting 2¼ hours); on the other hand, the curve obtained from the case of pyloric carcinoma shows no rise, but a steady fall of 5.5 mm.

Method of Collecting Alveolar Air.

For a description of the physiological processes of which these changes are the expression the reader is referred to the article by the writer and Dr. Bennett,² the present communication is not intended to be more than preliminary. The samples of alveolar air were collected by the Haldane-Priestley method, and the analysis was made with Haldane's gas analysis apparatus, less delicate methods, such as that of Fredericia, proving useless. The technique is as

follows. Before the patient's breakfast two samples of alveolar air are collected. The patient expires as forcibly as possible into a long rubber tube; after full expiration he closes the end of the tube with his tongue, and a sample of the last air expired is drawn off from the tube into an evacuated receiver attached to the tube as near the patient's mouth as possible. Two samples are collected in this manner, one taken at the end of an inspiration, one at the end of an expiration. The percentage of CO₂ is then determined by analysis with Haldane's apparatus, the mean of the

very wide variations in gastric secretion, ranging from extreme hyperchlorhydria even to achlorhydria, occur in quite healthy persons.^{2 3}

Advantages of the Method.

The above curves provide examples of the very definite pictures yielded by this method in various pathological conditions. The following advantages distinguish it from other methods in use:—

1. The analysis of alveolar air does not cause the subject any discomfort whatever, hence it can be employed even in patients in whom nervousness, or some other general condition, forbids the passage of stomach tubes of any type. The insertion and retention of the stomach tube in the fractional test-meal produces in some few persons considerable discomfort, with nausea, retching, and salivation. It is difficult to believe that gastric digestion follows its usual course under these conditions; hence in such persons the test-meal must give misleading results. In the method described in this paper, on the other hand, the patient, if not informed, would not even know that his digestive system was under examination.

2. The method gives an index of the *total* amount of acid or alkali being secreted from the blood by the gastric or other digestive glands, and hence is independent of neutralising factors such as mucus and regurgitation which affect ordinary gastric analyses.

3. It gives a measure of secretory activity below the pylorus as well as that of the stomach.

4. The form of test-meal is immaterial provided that a fixed standard be selected, allowing comparisons with the curve shown by normal persons after the same meal.

A paper is in preparation in conjunction with Dr. Bennett dealing with a large number of pathological cases in which the results obtained by this method will be shown to be parallel with those obtained by the fractional method of gastric analysis.

References.—1. Variations in Alveolar CO₂ Pressure in relation to Meals, E. C. Dodds, Jour. Physiol., 1921, liv., 342. 2. The Gastric and Respiratory Response to Meals, T. Izod Bennett and E. C. Dodds, Brit. Jour. Exp. Path., 1921, ii., 58. 3. A Study of Gastric Secretion, T. Izod Bennett and J. A. Ryle, Guy's Hosp. Rep., 1921, lxxi., 286.

inspiratory and expiratory samples being taken to represent the tension. The patient then has a standard breakfast, composed of a glass of milk and three rusks. After the meal samples are collected and analysed quarter-hourly until the tension remains constant for two readings.

Conditions giving Characteristic Curves.

We find that the following conditions when investigated by this method give curves which are at least as characteristic as those obtained by the fractional test-meal: (1) hyperchlorhydria, (2) hypo- and achlorhydria, (3) rapid emptying of stomach, (4) carcinoma of stomach, (5) pyloric ulcer. When a result is obtained indicating the presence of any one of the first three of these it is important to remember that

Clinical Notes : MEDICAL, SURGICAL, OBSTETRICAL, AND THERAPEUTICAL.

A CASE OF MALIGNANT PUSTULE WITH MULTIPLE LESIONS.

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THE following case is somewhat similar to one reported by Dr. W. T. G. Davidson in THE LANCET of Jan. 19th, 1918 (p. 104), and is of interest in that it repeats several of the unusual features described by him.

K. E., a butcher, skinned on Jan. 22nd a bullock, which the following day was found to have died of anthrax. On hearing of this K. E. had his shirt and underclothes disinfected and washed his arms in disinfectant. He did not, however, have his outer clothes disinfected. On the 30th a small pimple appeared on the back of his right hand

between the thumb and first finger. It was very itchy and irritable and there was a thin clear discharge from it. Condition was not diagnosed as anthrax until Feb. 2nd when the patient was admitted to this hospital.

On admission he was found to have a typical malignant pustule on the dorsum of the right hand between the first and second metacarpals, measuring half an inch in diameter and showing central eschar, ring of vesicles, and surrounded by a zone of inflammatory oedema. There was brawny oedema of the radial side of the hand, but this did not extend above the wrist, nor was there any lymphangitis or enlargement of lymphatic glands of the arm. A second, but much smaller pustule (which had not been noticed by the patient) was found on the radial side of the left forearm at the junction of the upper and middle thirds surrounded by a zone of oedema about five inches in diameter. Two small pimples were noticed lying to the outer and upper side of the latter, but these did not present the typical appearances of malignant pustule and were not surrounded by oedema. No lymphangitis or lymphadenitis of left arm. Patient's general condition was apparently unaffected and there was no pyrexia. Smears from the first and second pustules showed Gram-positive anthracoid organisms and staphylococci, the third and fourth pimples showed staphylococci only. The two pustules were excised on Feb. 2nd, and the patient was given 40 c.cm. of Sclavo's serum subcutaneously into the abdomen. On the following morning as there was some spread of the oedema on the left arm a further dose of 20 c.cm. of serum was administered. Patient made an uninterrupted recovery.