patient consented. The appendix was seized with a clamp and brought through the internal ring into the wound and its base exposed without any difficulty. Traction on the appendix caused the patient to complain of a dragging and nauseating pain which he referred to the region of the umbilicus. The mesentery of the appendix was ligated with fine silk and divided. The tightening of the ligature caused the pain described above. A cuff of the outer coats of the appendix was turned back about its base, and in reply to a question the patient stated he felt nothing. Care was taken during this procedure to avoid traction, the cecum lying in place at the internal ring. The base of the appendix was clamped, crushed and burned across with a cautery; there was no sensation during the procedures. A purse-string suture was placed about the base of the appendix in the cecum, turning in the stump of the appendix. There was no pain. The small intestines were again tested with negative findings as to sensibility. The edge of the sac was now clamped and drawn on, bringing forth a complaint of the same dragging and nauseating pain. The operation lasted in all two hours, and was completed without any further complaint. The pulse at the beginning was 60 and at the close of the operation was 60. The highest pulse rate was 70. This occurred when the skin incision was made under salt solution infiltration and during the division of the neck of the sac, and again during traction on the mesentery of the appendix.

PREPARED AND PREDIGESTED FOODS.*

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Economists tell us that in the struggle for existence a quarter of the income of a civilized family is paid out for lodging, a quarter for clothing and a half for food. The savage, who requires neither clothes nor modern lodging, expends his economic force in the capture of game and the raising of corn. In view of the physical well-being of savage races and of ignorant peoples throughout the world, it must at once be apparent that the normal instinct of appetite is a faithful guide for the nutritive requirement of mankind.

There will be no escape from the judgment, "By the sweat of thy brow shalt thou eat bread," until some one realizing the dream of Berthelot shall perfect a cheap process for the manufacture of veritable ambrosia from sawdust. Emil Fischer has been pictured in a cartoon as the master of a food factory located at a coal mine. Fischer, however, remarks that he who would eat his synthetically prepared sugars and peptones must, indeed, be a wealthy person.

Man is a machine developing mechanical energy and producing heat at the expense of the potential energy contained in fat, starch and proteid. A widespread error is that this requirement for energy is variable and may be largely reduced by diminishing the intake of food. Such a belief on the part of a healthy man is automatically corrected by his appetite, leading him to eat more bread for example. But where the individual is under the care of a physician, taking his food by the physician's orders, the food requirement of the body should be very clearly understood.

Two points stand out boldly in this connection. In the first place there must be sufficient proteid food ingested to protect the organism from proteid loss, and secondly there must be given a sufficient heat value in fats or carbohydrates to protect the body fat of the person and prevent emaciation. As regards the proteid requirement, it has been found by many investigators that

the average fasting man eliminates 10 grams of nitrogen in his urine, which corresponds to a destruction of 62.5 grams of proteid or the equivalent of about 300 grams of meat per day.

After prolonged fasting with extreme emaciation the nitrogen in the urine may sink to 5 grams or half what it was at first. In the case of starvation, proteid metabolism furnishes about 15 per cent. of the total fuel required by the organism and the remaining 85 per cent. is obtained by burning the body's fat. If carbohydrates be introduced alone into the circulation of a man who previously has been fasting the proteid metabolism is considerably reduced. It has also been found that where a mixed diet rich in carbohydrates is given containing 60, 50, or even 25 grams of proteid, a loss of body proteid may be prevented. In other words, the nitrogen contained in the proteid ingested is exactly eliminated in the excreta without any draft on the body's own proteid store. Such a condition is known as nitrogen equilibrium.

I do not wish to be misunderstood as commending these possible minima of proteid ingestion as being the most desirable, but I am citing the work of Chittenden and others only to emphasize the minimum of proteid ingestion below which waste of body proteid ensues. I agree with Meltzer in the idea that such a minimum is below the "factor of safety."

Passing now to the second consideration, the fuel requirement of the organism, it has been found repeatedly that a fasting man at light work and weighing 70 kilograms produces 2,240 calories of heat or 32 calories per kilogram in twenty-four hours. This is the fasting man's requirement of energy. It may be otherwise stated as being that quantity of heat capable of raising 22.4 liters of ice cold water to the boiling point. If this person were fed on a mixed diet his requirement of energy would be raised from 32 to 35 calories per kilogram of body weight. It is, therefore, apparent that food only slightly increases heat production. If too much food be given it is retained in the body; if too little, the body substance is attacked to make up the requirement of energy. It must, however, be remembered by the physician that in the case of persons confined to their beds this requirement falls to 1,750 calories, or 25 calories per kilogram, since equable temperature and muscular rest reduce the amount of needed fuel.

Ignorance of the unremitting demands of the organism for a definite quantity of dynamic energy leads to great error. I have in mind a diabetic woman whose physician told her to take a "proteid diet" without telling her to take 200 grams of fat as well, and who as a result lost 105 pounds in three months.

As concrete examples of a ration covering the energy requirement of the normal organism it may be said that two pound loaves of bread contain 2,390 calories and 64.4 grams of proteid substances, while four quarts of milk yield about 2,400 calories and contain 140 grams of proteid. The bread costs 10, the milk 20 cents. It is evident that this quantity of fuel for the human machine is not to be compressed into insignificant pellets. The ration of dried meat called pemmican, and of half a pound and more of fat, represents the most concentrated arrangement of fuel value and is used by travelers in polar regions.

The mention of bread, or of milk, or of bread and milk, as a constant dietary arouses at once the feeling of personal distaste. Bread and milk are easily digest-

* Read in the Section on Practice of Medicine of the American Medical Association, at the Fifty-eighth Annual Session, held at Atlantic City, June, 1907.

ible and perfectly assimilable by any healthy person, but foods with a stronger flavor are usually sought for the maintenance of the body functions. Herein lies a harvest for the proprietors of any pleasant tasting substance which is sufficiently advertised. Among such substances are the "breakfast foods."

Take, for example, "grape-nuts"—a malted preparation of the entire wheat grain—which contains a large amount of soluble carbohydrate. A pound and a half of "grape-nuts" yields 2,580 calories, contains 81.5 grams of proteid and proteid-like substances, and costs 21 cents. Here then is a product, a pound of which has nearly one and one-half times the nutritive value of a pound of bread and which costs only twice as much as bread for use in nutrition. The extra price is a price for flavor alone. The advertised statement that the system will absorb a greater amount of nourishment from a pound of grape-nuts than from ten pounds of bread is obviously a falsehood, and for any one to believe that grape-nuts is in any way more specifically adapted as a food for brain and nerve centers than is, for example, bread and milk, is preposterously foolish. Grape-nuts has been selected because it is at present the most widely advertised of the breakfast foods, but the same analysis holds true of all. For many years the name of Voit was used as guaranteeing the purity of "Liebig's meat extract," yet all Voit's publications showed that the whole value of this material was in its flavor.

As regards the fuel value of the various malt extracts one may copy the statement of Hutchison in his "Food and Dietetics" that a dessertspoonful has a fuel value of 60 calories, or less than the same measure of honey, which contains 75 calories. The sugar of honey is invert sugar and ready for immediate assimilation.

There are numerous fabrications in the form of biscuit or crackers, and these are often fortified by the addition of casein or gluten. In so far as these are pleasing to the taste they are helpful to the digestion. The question of their food value concerns the physician only in the case of diabetic patients. Such patients covet carbohydrates, and biscuit may be prepared containing 80 per cent. of gluten and only 10 per cent. of starch which may greatly comfort the sufferer. Diabetic foods have been analyzed recently by Winton of the Connecticut Agricultural Experiment Station, who shows that some of the widely used "diabetic flours" are scarcely different from ordinary flour and constitute base and contemptible frauds.

The value of cod liver oil lies not entirely in the fat which it contains, but in the presence of a large quantity of fatty acid. When the latter reaches the intestine it forms a soap with the alkali, and this soap produces an emulsion of any fat which may be present, thereby giving an immediate opportunity for the action of the digestive ferment steapsin.

All of the peptone preparations consist chiefly of albumoses. Voit has pointed out that these substances are likely to produce diarrhea, and Cohnheim states that it is undesirable to administer more than 30 grams of somatose daily to a man. Such a quantity contains about 18 grams of proteid matter.

Finally there is a class of predigested proteids which are sold in solution and are commended to the purchaser in doses of one-half to one tablespoonful. Characteristic of this group are liquid peptonoids and panopepton, of similar composition and both containing considerable alcohol. As regards these preparations, the physician

must remember that a tablespoonful contains only a gram of proteid material. Also that a whole pint bottle contains about 25 grams of proteid and as much alcohol as in a quart bottle of claret. Assuming that the proteids contained in these preparations are of a physiologically valuable type, then at least a pint a day would be absolutely essential to prevent loss of body proteid. It is said that many patients have died of proteid starvation through the ill-advised administration of these preparations. It may well be that these liquid foods are sometimes helpful as flavor and stimulant, but their limitations should be fully recognized.

It seems that the physician should be rightly informed as regards the requirements of nutrition. It would be well to remember the ready digestibility of white of egg, of beef juice, of peptonized milk. The wonderful improvement in the nourishment of hand-fed children should stimulate to further research along this line. No doubt much help will come from the dilution and subsequent enrichment of milk with cream and milk-sugar and the study of its action on the organism in disease. The basis of nutrition, whether in childhood or in the adult, in sickness or in convalescence, requires the administration of the proper quantity of proteid and of energy containing fats and carbohydrates and the preparation of this food in a palatable form.

[FOR THE DISCUSSION, SEE THE DEPARTMENT OF SECTION DISCUSSIONS IN THIS ISSUE.]

HOMOLOGOUS BACTERIA AS A VACCINE IN TUBERCULOSIS.*

PRELIMINARY REPORT.

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The object of this investigation was to obtain from sputum a standardized vaccine for tuberculosis. The product is called tubercle vaccine, since it resembles closely an emulsion of a tubercle.

PREPARATION OF SPUTUM.

1. Fresh sputum was carefully washed through six normal salt solutions.

2. The sputum was then thoroughly homogenized with an ordinary egg-beater for from ten to fifteen minutes.

3. An attempt was then made to separate the tubercle bacilli from the pus cells. Centrifugalizing, the whirling table, forced and simple filtering through many varieties of filter papers, through various cloths, sand, wool, cotton, glass wool, were tried with rather poor success. Thirteen layers of thin, closely-woven cloth with "threads drawn" and with the "drawn threads" parallel were used in the hope that the rods would pass more easily than the spherical cells through a filter with merely long narrow meshes. This made too coarse a filter. A fine sponge was allowed to take up the homogenized sputum. Specimens from the upper surface of the sponge showed no separation of the tubercle bacilli and leucocytes. With a rubber bulb on a glass tube, bubbles of sputum were blown and specimens taken of the thin delicate wall of the bubbles, but the cells and tubercle bacilli were still present in the same proportions. The least unsatisfactory method was to collect

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