

under each genus. Altogether there are 258 forms, of which 161 are species or subspecies, the others being classed as varieties. Many varieties and several subspecies are new, but described only in Russian. The habits and distribution in Russia of each species is given often in much detail. The Caucasus region appears to be the richest in species. The author recognizes but four subfamilies: Camponotinae, Dolichoderinae, Myrmecinae and Ponerinae.

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DIET AND ENDURANCE AT BRUSSELS

Mlle. DR. J. IOTEYKO, head of the laboratory at the University of Brussels, and Mlle. Varia Kipiani, student in science, have published a monograph of seventy-seven pages: "Enquête Scientifique sur les Végétariens de Bruxelles."¹ In this monograph the question of vegetarianism is studied by several methods. The authors have become convinced that the vegetarian régime is for the most part a more rational one than the highly nitrogenous diet ordinarily prevailing in Western Europe and America.

In the brief introduction, general considerations in regard to diet are mentioned and special emphasis given to the subject of toxins. The authors quote, in behalf of their conclusions, the eminent French dietitian, Armand Gautier, "who, without himself being a vegetarian, praises the good effects of the vegetarian régime." The authors quote Gautier as follows:

The vegetarian régime, modified by the addition of milk, of fat, of butter, of eggs, has great advantages. It adds to the alkalinity of the blood, accelerates oxidation, diminishes organic wastes and toxins; it exposes one much less than the ordinary régime to skin maladies, to arthritis, to congestions of internal organs. This régime tends to make us pacific beings and not aggressive and violent. It is practical and rational.

The authors, while apparently classifying themselves as advocates of vegetarianism, admit that in certain cases it is necessary to prescribe meat as a "medicament"—"just as

one prescribes sometimes alcohol and other poisons." The authors also observe that the transition to a vegetarian diet should be gradual.

The personal history is traced of forty-three vegetarians of Brussels. Among other interesting observations is the following:

For the most part the vegetarians appear younger than their age; notably the ladies are distinguished by their clear and fresh complexion.

The experiments conducted by Mlles. Ioteyko and Kipiani are restricted to vegetarians who have been such for several years. The experiments were, for the most part, comparisons of strength and endurance. So far as strength is concerned, very little difference was discovered between vegetarians and "carnivores." In endurance, on the other hand, a very remarkable difference was found, the vegetarians surpassing the carnivores from 50 to 200 per cent., according to the method of measurement.

This result agrees with the experiment on nine Yale students described in SCIENCE.² These subjects, by dint of thorough mastication, gradually lost their taste for flesh foods. At the end of five months, while not becoming vegetarians, they had reduced their consumption of flesh foods to one sixth of the amount to which they had originally been accustomed. Their strength remained practically stationary, but their endurance, according to the gymnasium tests, was increased on an average by over 90 per cent.

The method of measuring endurance used by the Belgian investigators was by means of the Mosso ergograph. One of the fingers is used to raise a weight as far as possible. As the experiment proceeds and fatigue sets in, the height to which the weight can be raised is gradually reduced until no further contractions are possible. If a curve be constructed representing the height of the successive contractions, it is called a "curve of fatigue," and it is found that this curve is "different for different individuals, but is constant for the same individual from one day to another and even after an interval of several years, if the

¹ Brussels, Henry Lamertin.

² N. S., Vol. XXIV., No. 620, Nov. 16, 1906.

conditions of the experiment remain the same."

The authors compared the endurance of seventeen vegetarians, six men and eleven women, with that of twenty-five carnivores, students of the University of Brussels. Comparisons for the right hand differed somewhat from those for the left, the superiority of the vegetarians being greater for the latter than for the former. Comparing the two sets of subjects on the basis of mechanical work, it is found that the vegetarians surpassed the carnivores on the average by 53 per cent. Comparing the two groups on the basis of the number of contractions—or, what amounts to the same thing, the length of time during which the ergograph could be continuously operated—it was found that the vegetarians could work on the ergograph two or three times as long as the carnivores before reaching the exhaustion point.

This last result corresponds to conclusions* of the present writer in an experiment in which forty-nine subjects, about half of whom were flesh-eaters and half flesh-abstainers, were compared. It was found that the flesh-abstainers had more endurance, as measured by gymnasium tests, than the flesh-eaters, to the extent of from two to three fold.

The Brussels investigators found also that the vegetarians recuperated from fatigue far more quickly than the meat-eaters, a result also found in the Yale experiment.

An interesting mathematical study of the fatigue curve is made in which the equation

$$\eta = H - at^3 + bt^2 - ct$$

is used. In this equation η represents the height of the contraction at any time; t represents time and H , a , b , c , are constants. H is the height of initial or maximum contraction. The authors believe that a is a parameter measuring the toxicity of albumenoids in their effect on the muscles. The numerical value of a is very small, but as it is a coefficient of the cube of the time during which the experiment is continued, the cumulative effects of these toxins is very rapid. The parameter b is believed to

* "The Influence of Flesh-eating on Endurance," *Yale Medical Journal*, March, 1907.

refer to the excitability of the central nervous system, and c to the utilization of carbohydrates. The authors refer to previous memoirs of J. Ioteyko to justify these interpretations of the coefficients. After laborious computations, it is found that the average of the coefficient a for the carnivores is .00305 and for the vegetarians .00015. The average coefficient b for the carnivores is .086 and for the vegetarians .023. The average coefficient c for the carnivores is 1.94 and for the vegetarians 1.46. The average of the constant H of the carnivores was 38.7 and for the vegetarians 31.7.

The authors conclude by advocating a vegetarian régime as a proper system for working men, and believe that its use would reduce the accidents on railways and in industry which come from over-fatigue, increase the productivity of labor, as well as have other economic benefits.

The monograph of Mlles. Ioteyko and Kipiani is especially interesting as confirming the trend of many modern studies. It agrees in substance with the conclusions in a popular book published a year ago in England by T. Russell on "Diet and Strength." The philosophy, however, by which these harmonious results are explained by various investigators is not the same. Russell and Mlles. Ioteyko and Kipiani regard the inferior endurance of meat-eaters as due to specific toxins in flesh foods, and therefore are avowed vegetarians. Under Professor Chittenden's theory, on the other hand, the facts brought forward by Mlles. Ioteyko and Kipiani, as well as by Mr. Russell and the writer, would be interpreted as primarily due to the superiority of "low proteid" rather than of a non-flesh diet. For this and other reasons, Professor Chittenden and most other modern physiologists avoid the term "vegetarian" as inappropriate and misleading. A vegetarian may, through a wrong selection of his food materials, suffer from the evils of high proteid, and a flesh-eater may, if he consumes flesh sparingly, have the advantages of a low-proteid diet.

It is possible that flesh-eating, as ordinarily practised, is injurious both because of ex-

cessive proteid and because meat, as such, contains poisonous elements. It is well known that Liebig came to repudiate the idea that the extractives of meat were nutritious, and that investigation has shown them to be poisonous. Recently, Dr. F. B. Turck has found⁴ that dogs, mice and rats fed on meat extractives exhibit symptoms of poisoning and often die. The poisonous effect is aggravated by intestinal bacteria which find in these extractives an excellent culture medium. Dr. Turck concludes:

(1) It is clearly evident from these experiments, which correspond to the investigations of others, that the injurious effects of meat are not due so much to the muscle proteid, myosin, as to the extractives.

(2) That the injurious effects of the extractives are increased through the action of intestinal bacteria.

Dr. Turck does not find any evidence that the extractives in small quantities are injurious.

Dr. Turck therefore concludes that the "high liver" who uses much flesh and also an excess of starch and sugar is a "bad risk" for life insurance companies. He recommends, if meat is to be used, that the extractives first be removed by special processes which he explains. He finds that the remaining part of the meat is highly nutritious and an invaluable aid in many cases of weak stomachs. He supplies much clinical evidence of the evils of ordinary meat-eating, as well as of the benefits obtainable from extract-free meat.

These investigations, with those of Combe of Lausanne, Metchnikoff and Tissier of Paris, as well as Herter and others in the United States, seem gradually to be demonstrating that the fancied strength from meat is, like the fancied strength from alcohol, an illusion. The "beef and ale of England" are largely sources of weakness, not strength. Whether in moderation they are harmful may still be a matter of conjecture. While the trend of recent experiments is distinctly against the excessive use of flesh foods, there are still needed many more

⁴"Effect on Longevity of High Living," by Fenton B. Turck, M.D., *The Medical Examiner and Practitioner*, Vol. XVII, No. 8, August, 1907.

experiments—medical, athletic and industrial—before the economics of diet can be established on a secure basis. The experiment with a vegetarian or semi-vegetarian diet at the University of Chicago, which Director Stagg is to make with the athletic teams, will be watched with interest.

Miles, Ioteyko and Kipiani seem to place a larger reliance on the ergographic tests than most physiologists. A thoroughly reliable method of measuring endurance seems still to be a desideratum.

IRVING FISHER

A NEW NATIONAL BUFFALO HERD

THE buffalo herd which was presented to the national government by the New York Zoological Society last year, to form the nucleus of a great southwestern herd, was shipped on October 11 to the new range of 7,680 acres that has been prepared for it in the best portion of the Wichita Game Reserve, southwestern Oklahoma. On October 10 fifteen fine animals, the pick of the splendid herd of forty-five head in the New York Zoological Park, were crated for shipment, each in a roomy and comfortable crate, and shipped to Cache, Oklahoma. In view of the nature and object of the shipment—a gift to the people, for the express purpose of helping to preserve the American bison from ultimate extinction—the American Express Company and the New York Central Lines transport the two cars free of charge from New York to St. Louis, and the Wells-Fargo Express Company also makes a free gift of the transportation over the 'Frisco Road from St. Louis to Cache. Both these favors are greatly appreciated by the Zoological Society, which had undertaken to make delivery at Cache.

In 1906, the New York Zoological Society received from the director of the Zoological Park a suggestion that the society offer to the national government, as a gift, a herd of fifteen buffaloes with which to start a new national herd. The proposal was warmly endorsed by the executive committee of the society. The offer was made to the Secretary of Agriculture, who immediately accepted it,