Aberdeen, or for the assistance of bacteriological research in connection with the Royal Infirmary of Edinburgh and the Glasgow Royal Infirmary.

IN recognition of the bequest of his valuable library of some 5,000 volumes to the Field Museum of Natural History, the late Dr. Berthold Laufer, formerly curator of anthropology at the museum, has been posthumously honored by election as a contributor of the institution. Contributors form a special class of membership designating those whose gifts in money or materials range in value from $1,000 to $100,000.

TWO new fellowships for graduate students in botany and chemistry for the coming year at the University of Oklahoma have been announced by Dr. Homer L. Dodge, dean of the graduate school. The Ray M. Balyeat fellowship, offering a $600 stipend for study in any school, will be given to encourage students to study chemical substances concerned with allergy. A fellowship and stipend, not yet determined, to encourage the study of wild plants of Oklahoma and their possibility as ornamentals, is being offered by Oklahoma garden clubs.

A NEW quarantine prohibiting movement of elm trees out of regulated areas in New York, New Jersey and Connecticut, because of the spread of the Dutch elm disease, took effect on February 25. The quarantine applies to all plants or parts of plants of all species of elms, whether grown in nurseries, forests or on private property. The campaign is under the direction of L. H. Worthley, of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, with headquarters at White Plains, New York.

DISCUSSION

BALANCED DIETS, NET ENERGY VALUES AND SPECIFIC DYNAMIC EFFECTS

IN a recent number of SCIENCE[1] H. H. Mitchell presents a theoretical discussion of the subject of this communication, involving certain of the writer's published conclusions.

After developing a line of argument similar to and in harmony with that of the writer in the publication of the so-designated "law of maximum, normal nutritive value," Mitchell discusses the significance of this principle in relation to net energy values, saying, in part:

> With these definitions in mind, the first implication of the above-defined conception of nutritive balance in a ration or diet is that except for differences in digestibility, the net energy of all perfectly balanced rations is the same under the same conditions of feeding, or somewhat more precisely, the net availability of the metabolizable energy of all perfectly balanced rations is maximal for any imposed conditions of feeding.

Further, he says:

> However, Forbes' recently announced "law of maximum, normal nutritive value," although it advocates the use of completely balanced rations in determinations of net energy values, does not state nor imply that the net availability of the metabolizable energy of such rations will be maximal and identical.

It is true that, in my "law of maximum, normal nutritive value"[2] I avoided making any statement or implication to the effect that the net availability of the metabolizable energy of completely balanced rations is maximal and identical (though we had discussed the idea), because I can not conceive of balanced rations—as practicable entities—being so perfectly balanced that there would be no individuality of dynamic effect of the nutrients serving the same purposes in different rations, and that there would be no differences in either the excess nutrients, or in substances present without nutritive value, which would affect the economy of utilization of metabolizable energy.

One must remember, in theorizing, that in feeding practice we deal not with pure nutrients, of known identity and character, but—in each feeding stuff—with a vast complication of little-known substances.

Also, it is only fair to call attention to Mitchell's misstatement to the effect that my law of maximum, normal nutritive value "advocates the use of completely balanced rations in the determination of net energy values." In publishing this principle I did not mention "completely balanced rations," but did use the expression "a ration which is qualitatively complete and quantitatively sufficient"—which has a distinctly different meaning in that the idea of a complete diet provides only for the presence of all required nutrients, in the necessary quantities, while the perfectly balanced ration—literally—must not only be complete, but must not contain an excess of any nutrient. It is true, however, that, at an earlier date, I had—less carefully—used the expression "completely balanced rations" in a similar discussion.[3]

Proceeding further, Mitchell calls attention to my statement that "an individual foodstuff expresses its normal and most characteristic nutritive value—only as it is a part of a ration which is qualitatively com-

[1] SCIENCE, 80: 558–561.
[2] SCIENCE, 77: 306–307.
[3] *Proc. Amer. Soc. Animal Production, Ann. Meeting,* 1932: 32–40.

plete and quantitatively sufficient. . . ." The question which Mitchell raises is, in reality, "which is the 'normal and most characteristic value' of a foodstuff—that determined by its full potentialities, when it is adequately supplemented, or by its limitations, when fed alone?" The difference is simply one of point of view. It is normal to use feeding stuffs as components of approximately complete rations; they are not commonly fed alone; and I have used the word "characteristic" to mean "representative."

Mitchell states that "the recent developments in the net energy conception, initiated and defended by the Pennsylvania group, have tended to complicate the problem of net energy determinations and perhaps even to discourage those who have hoped to put the conception to practical use in the rationing of farm animals."

There have been no recent developments in the net energy conception, so far as I know. It remains as at first proposed, and it is as unassailable as the law of conservation of energy. But there has been much new light cast upon the subject of energy metabolism, and a searching analysis of the problem of determining energy values, in studies published from this institute—which, however, should be discouraging only to those who adhere to the objective of determining net energy values *of individual feeding stuffs as constants.*

The idea of determining net energy values of rations, however, is worthy of consideration. This is a logical deduction from the work of this institute. I have made this deduction; have advocated the determination of such values, and have enumerated some of their apparent uses in the study of problems in the field of animal production.[3]

In regard to Mitchell's speculations as to the cause of specific dynamic action, the relation of the dynamic effects of nutrients to the combinations in which they are fed, etc., we do not care to comment, especially since the methods of determination of specific dynamic effects, and the measurements of these effects—in the literature—have been so unsatisfactory, in fact, so largely fallacious, in the light of findings of this institute during the past six years, especially as set forth in a very recent paper by Kriss, Forbes and Miller,[4] which places the problem of determining specific dynamic effects of nutrients in a new and vastly improved position.

The new point of view and procedure depend upon Rubner's idea[5,6] of a specific dynamic effect of body substance katabolized, from which follows the hypothesis (Forbes, Braman and Kriss,[6]) of a status of minimum heat production of life in which the energy requirement of the animal would be rendered available without waste of heat—that is, without energy expense of utilization; heat increments (dynamic effects) as usually determined at planes of nutrition below energy equilibrium being less than the true energy expense of utilization by the amount of the dynamic effect of body nutrients katabolized (Forbes, Braman and Kriss[7]); heat increments determined above maintenance, with the heat production of maintenance as the base value, therefore representing the true energy expense of nutrient utilization.

We are free to admit, however, that if—as we have concluded—net energy values of individual foodstuffs are not constants, because of the supplementing effects of food combination, in rations, and other conditions affecting the economy of food utilization, then it is conceivable that, for similar reasons, specific dynamic effects of individual nutrients likewise are not constants. We have unpublished results on conditions affecting specific dynamic action, and a second year's experiments on the subject are in progress.

The recent studies of this institute on specific dynamic effects and their determination afford an improved basis of understanding and procedure from which to investigate this question. In this connection I would propose that it would save confusion to limit the term "specific dynamic effect" to signify the dynamic effect of specific kinds of nutriment, and to use the equivalent term "heat increment" to signify other dynamic effects—that is, those which are not specific of particular kinds of nutriment.

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MORE EVIDENCE ON THE STRUCTURE OF CHROMATOPHORES

A RECENT communication by Herrick[1] regarding the discussion between Sumner and Mast as to the nature of the chromatophore leads me to enter the lists. Like Herrick, I am not concerned with the problem of terminology; I disagree with Herrick, however, on several points of structure and function. The evidence I wish to present in brief, below, is from two types of chromatophore differing from each other and from Herrick's material. Herrick used epidermal melanophore of frog tadpole; my observations were on melanophore of goldfish and chromatophore of squid.

First, Herrick comments that he has "seen no evidence to support the statement of Mast[2] that pigment granules move on definite paths through the cytoplasm." In melanophores of goldfish with Chambers'

[3] *Jour. Nutrition,* 8: 509–534.
[4] "Die Gesetze des Energieverbrauchs bei der Ernährung," Leipzig und Wien, 1902, S. 370.
[5] *Jour. Agr. Research,* 37: 285, 1928.
[6] *Jour. Agr. Research,* 40: 77, 1930.
[7] SCIENCE, March 16, 1934.
[1] SCIENCE, November 10, 1933.