(4) Adopt a specific plan.

(5) Determine ways and means of obtaining funds to guarantee the financing of the organization during its first three to five years. (It would be assumed that the organization would be self-supporting at the end of this time).

(6) Select and appoint a permanent executive secretary and establish a permanent office.

It would be assumed that this proposed organization would be one in which biologists would participate for the concrete benefits they would derive from it.

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A POSSIBLE EXPLANATION OF "FREEZING" BEHAVIOR IN RATS

CURRENT adherence to the doctrines of biologism in the study of animal behavior has tended to obscure interest in the beginning of socially determined action and to favor explanations based on hereditary or innate patterns of individual variation. Thus in maze studies with small animals where the organisms are housed in groups in one cage, differences in learning scores in the maze are seen as the product of heredity or of the specific conditions of diet and experimentation. Very rarely is mention made of social interaction in the group-housing situation, although it is well known that patterns of dominance, aggression, food-hoarding and sex play exist. Surely some correlation may be expected between behavior under experimental control and the social environment of the living cage.

The author had an opportunity to apply the implications of the foregoing to random observations made over a period of some years during which the behavior called "freezing" was studied incidentally. "Freezing" is a phenomenon found particularly in learning experiments with rats and guinea pigs. It refers to a state of immobility on the part of the organism when it is inserted into the learning apparatus. The subject simply sits at one point in the maze. Increase in motivation is rarely effective in causing cessation of "freezing," which may continue for many trials and is then apt to disappear suddenly. The difficulties in incorporating data from such animals into learning studies have led some authorities to recommend the elimination of the organisms and the data from consideration. Where any discussion is found of the phenomenon, it is usually ascribed to emotional disturbance or to "pure cussedness."

The data under discussion here were derived from two groups of animals, one living in groups of six rats to a cage, the other consisting of animals in isolated, single cages. Of the 124 rats in the first group, eighteen manifested "freezing." Only two rats in the other group displayed the behavior. Sex, age and stock variations were ruled out as causal, as were differences in handling since all these factors were identical for both groups. The only major difference in the treatment of the two sets lay in the manner of their housing and its consequences. Systematic observation of the behavior of the group-housed rats led to a variety of data of which only part will be presented here as preliminary to a larger report. This note takes into account only that aspect of the inter-organismic relationship in which aggression of one or more animals against another is manifested. Social hierarchies such as those found among chicks and baboons are not well established in rats but fighting is common and there have been some observations of dominance and submissiveness under these circumstances. In our animals, of those which "froze" from the group-housed experiments, fifteen were definitely and rather consistently the submissive or aggressed against organisms. The remaining three were all dominant and winners in fighting. It would seem then that the phenomenon in question is the result of the hitherto uncontrolled factor of social interaction in the living quarters of the experimental animals.

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SCIENTIFIC BOOKS

VIRUS DISEASES

Virus as Organism. Evolutionary and Ecological Aspects of Some Human Virus Diseases. By FRANK MACFARLANE BURNET. 134 pp. Cambridge, Mass.: Harvard University Press. 1945. $2.00.

THIS book, which is an expansion of the Dunham Lectures given at the Harvard Medical School, presents a discussion of some virus diseases of man from a consistently biological viewpoint. The discussion is the best that has ever been presented of the broad evolutionary and ecological aspects of virus disease. The author, who is a distinguished investigator and director of the Walter and Eliza Hall Institute of Research in Pathology and Medicine in Melbourne, Australia, does not pretend to discuss representative virus diseases or to present a balanced picture of the causative agents. He restricts himself to the six virus diseases which have been under investigation in his laboratory and confines his central theme to a por-

trayal of the primary biological attributes of viruses, namely reproduction, variation, survival and evolution. He believes that viruses are micro-organisms which have evolved by parasitic degeneration from larger micro-organisms, that heritable variations in viruses arise by a process of discontinuous mutation essentially similar to gene mutation in higher forms and that the mass transformation of a strain as observed in practice is the result of selective survival and overgrowth of one or more mutant types. It is suggested that, although important future developments in the finer laboratory study of viruses can be looked forward to with certainty, the pragmatic necessity will remain for regarding viruses as organisms—self-reproducing, varying and surviving like other living beings. Discussion of recent developments in studies on chemical and physical properties of viruses is omitted, despite the fact that many of these, such as studies on the chemical composition of viruses and of virus strains, have a direct bearing on the basic problems of virus multiplication and variation. No attempt is made to deal with the admittedly very difficult task of reconciling the results of the physico-chemical approach with the biological viewpoint adopted by the author. However, this must not be regarded as adverse criticism of the book, for the author states at the outset, and constantly reminds his readers thereafter that the discussion is presented from a consistently biological angle. It is recognized that such a discussion can only give an incomplete account of the facts that are now known about viruses. The virtue of the book lies in the fact that the author writes only from the viewpoint with which he is most familiar and only about those viruses and diseases with which he has worked. As a result the book is highly authoritative and very stimulating. No other book has succeeded in bringing into such excellent focus an over-all picture of virus diseases from the standpoint of evolution and ecology.

The first chapter contains a discussion of the reproduction, variation and survival of viruses. The author points out that every virus particle derives by genetic descent from some similar particle and in turn possesses the power to produce, under appropriate conditions, replicas of itself and that there is no evidence that any virus arises *de novo*. He believes that protein production in general will eventually be understood in terms of replica production by subcellular, essentially living entities. This statement provides the key to the different attitudes that have been adopted by biologists and by chemists. In general, the biologist is content to view the over-all system as a growing, metabolizing, living entity and to take refuge in the "living state." The chemist, on the other hand, is quite willing to devote time and energy to the unraveling of the multiplicity of chemical reactions that go to make up the "living state." He is ready to debate whether the structures that participate in the final reaction that results in the production of a protein molecule are, in fact, "living." However, it is likely that chemists and biologists are closer in their thinking than might appear on the surface and that the viruses may provide the ground for a common meeting place.

In the second and third chapters on "Evolution and Change in Virus Disease" and "The Reaction of the Host to Virus Infection" the author draws from his generous store of knowledge of disease and presents stimulating and interesting discussions. He considers how viruses might have originated and dwells on the widely accepted view that viruses represent the degenerate descendants of larger pathogenic micro-organisms. The work of Beadle on the mold, Neurospora, is described in this connection. There is a provocative discussion as to whether virus diseases of man have resulted from the transfer, to the human host, of viruses that have evolved as specific parasites of some other abundant species. Many aspects of the interaction of virus and host are presented and it is emphasized that for any given disease the three major factors responsible for variation in character with time and place are past experience of infection, the age distribution of the community affected and the virulence of the current strain or strains of the pathogen responsible.

The following chapters are devoted to the ecological and evolutionary aspects of six virus diseases of man. These include herpes simplex, poliomyelitis, psittacosis and related infections, smallpox and similar pox diseases, yellow fever and influenza. The chapter on poliomyelitis is especially well written. Throughout these six chapters, the virus, its mode of survival, its characteristic range of variation and its possible evolution provide the center of attention. The importance of the transfer of virus infection from one host to another and the fact that transfers from animal reservoirs to man are taking place at present are stressed. One of the major modern accomplishments, namely, the development and effective use of a yellow fever vaccine, is not mentioned in the chapter on yellow fever. However, the eventual removal of one species as a host for a virus may be regarded by the author as relatively unimportant in the broad picture which he presents. As a whole these six chapters, as well as the concluding and introductory chapters, are written in an authoritative and interesting manner. The discussion is presented from a consistently biological point of view, and for this reason this book should not be used to introduce the novice to viruses. However, the book contains a most excellent discussion of the broad evolutionary

and ecological aspects of virus disease and should therefore be read by all who are interested in viruses.

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HIDDEN HUNGER

Hidden Hunger. By ICIE G. MACY and HAROLD H. WILLIAMS. Lancaster, Pa.: The Jaques Cattell Press. 1945. $3.00.

THE title of this book denotes the malnutrition resulting from diets which may satisfy hunger in the usual sense, but which are lacking in one or more of the specific nutrients required for optimum health and performance. Against a historical background, the book records the contemporary developments which have led to our present knowledge of the causes of this hidden hunger, and of ways of eliminating it. The authors, life-long students and investigators in nutrition, are particularly well qualified to deal with the field covered. Without sacrifice of scientific accuracy, the discussion is presented in language that the general reader can understand and profit from accordingly. The scientist also will find the book a source of much valuable information which is well documented with references.

The first chapter traces the origins of nutrition science which grew out of man's primary need for food and of his early observations on the relation of diet to disease. It reveals how our present knowledge has developed through the application of data obtained by research in many different fields, such as chemistry, physiology, agriculture, medicine and home economics. In the following chapter, the nutrition activities of important national and international organizations and conferences, past and present, are reviewed.

The choice of foods and their utilization are next considered, particularly in connection with problems of food habits, food fads and abnormal appetites. A discussion of the various nutrition deficiency diseases which are responsible for poor health follows. Food production receives attention in a chapter devoted to the basic importance of the soil as a source of our food supply. The contributions of soil, plant and animal science in improving this supply are discussed. Economic problems of land utilization are reviewed.

A comprehensive chapter considers the chemistry, physiology and functions of the various chemical substances with which nutrition science deals—the energy-forming nutrients, the amino acids and the many minerals and vitamins of which a complete diet must be composed. Succeeding chapters translate these nutrients into foods and into use. First, there is a discussion of the problems of food supply and of the various services involved in getting food from the farm to the consumer. Food processing, preservation and cooking are here dealt with. A discussion of fortified foods, notably enriched flour and bread, is included. A chapter entitled "Food in Action" makes a comparison between the knowledge available during World War I and World War II, thus revealing the large advances in nutrition science. Another chapter is devoted to the accomplishments during World War II in improving the industrial workers' health. A discussion of the development of rations for our armed services follows. It reveals the contributions which have been made by the newer knowledge of nutrition and by current experiments carried out to solve specific problems.

The final chapter is entitled "Food for Thought." It reviews recommendations set forth by the United Nations' Conference on Food and Agriculture as a background for a discussion of some of the problems which will arise in carrying them out. It closes with a review of some of the developments which should result in a healthier people in the future.

The foregoing summary indicates that the book has a much broader scope than is indicated by its title. Some readers may feel that an attempt has been made to cover too many topics and too many fields in a book of this size and purpose. Some of the topics are not very closely related to the title, but their discussion does serve to show the many factors which must be taken into account in advancing the field of nutrition. The diversity of topics discussed and the many long quotations in fine print may, at times, tend to distract the reader from the main theme. But these are minor matters with respect to a book which contains a large amount of valuable scientific information in a very readable form.

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