

his opinion, implies a return to the mystical, the occult and the supernatural.

In favour of this thesis Mr. Rawcliffe has been at pains to examine a good deal of the literature and has selected a number of instances which illustrate his point of view. Indeed, in one or two cases he is the first to attempt what he calls a "rational" explanation. Thus he considers endophasic enneurosis (unconscious whispering) to be the chief explanation of the majority of the experiments in extra-sensory perception, citing in support of his theory the work of Lehmann and Hansen (1895) and the more recent conclusions in the well-known case of the Latvian peasant girl, Ilga Kirps.

It is when Mr. Rawcliffe attempts to deal with the better class of experiments that his explanations begin to appear somewhat unconvincing. Thus his refutation of the validity of the conclusions drawn by Dr. Soal for some of his work will, I think, scarcely bear expert examination, and his omission of any discussion of the phenomena of such mediums as D. D. Home, Mlle. Tomczyk or Mrs. Piper suggests a bias which is to be regretted.

In spite of its deficiencies, however, this book remains a useful handbook for those who suspect that much of what passes for psychical research and which is often unfortunately supported by leading parapsychologists is scarcely worth the paper on which it is recorded. The book has a useful glossary of technical terms and a selected list of authorities; but the text contains more than the usual number of printers' errors.

E. J. DINGWALL

BIOLOGY OF HUMAN STARVATION

The Biology of Human Starvation

By Ancel Keys, Josef Brožek, Austin Henschel, Olaf Mickelsen, Henry Longstreet Taylor. Vol. 1. Pp. xxxii+764. Vol. 2. Pp. viii+765-1386. (Minneapolis: University of Minnesota Press; London: Oxford University Press, 1950.)

THE physiological effects of a shortage of food occupied the attention of many people during the Second World War, and plans were laid by various committees in Great Britain to study them immediately hostilities ceased. In the United States in 1944 Prof. Ancel Keys and his four colleagues decided to put the matter to the test of experiment. They received little encouragement from official sources; but, with the financial aid of various religious and commercial bodies, they launched their great 'Minnesota Experiment'. Sir Jack Drummond, who visited Prof. Keys and saw the experiment in progress, writes that he had rarely come into touch with an investigation "so meticulously planned and so enthusiastically carried through".

The subjects were young men who had registered as conscientious objectors and who were serving in various Civilian Public Service Camps. More than a hundred volunteered for the experiment; thirty-six were selected and, of these, thirty-two stayed the course. After a control period of twelve weeks, during which time the men ate an adequate diet and were subjected to a battery of tests, the period of semi-starvation started. Two meals a day were served, consisting largely of whole wheat bread, potatoes, cereals, turnips and cabbage. These foods provided each man with an average of 1,570 calories

a day. The semi-starvation period lasted for twenty-four weeks, and by the end of this time the subjects had lost about 25 per cent of their body weights. The photographs at the end of Vol. 2 provide convincing evidence of this. Then followed the twelve weeks of rehabilitation. For this, the men were divided into four groups of eight, each group receiving a different number of calories, varying from 1,930 to 2,940 a day. These calorie groups were further sub-divided so that some of the men in each received supplements of protein or of vitamins. It was soon realized that the allowances of food during this period were too small and they were increased; but it seems likely that, even so, they were not large enough. In any event, when twelve of the men were given the opportunity to eat as much food as they wanted after the official period of rehabilitation had ended, they managed to consume enough food to provide them with 7,000-10,000 calories a day. The whole experiment ended in December 1945.

The investigators had by this time amassed a vast amount of information about the reactions of the bodies and minds of their subjects to a shortage of food, and they were faced with the problem of putting it all together. They decided to make as complete a job of it as they could, and to try to give a comprehensive survey of world knowledge of human starvation in addition to presenting their own findings. The results of their labours are contained in the two large volumes, running to nearly fourteen hundred pages, at present under review. The work of putting all this literature together demands fully as much admiration as the carrying out of the experiment. The morphological, biochemical and physiological effects of starvation are dealt with in the first volume, and the psychological problems are considered in the second, along with special problems such as the relationship of undernutrition to diabetes, neoplastic disease, and to infectious diseases, particularly tuberculosis.

The various results of the Minnesota Experiment take their place among the findings of all the other authors to whose work reference is made. This makes it difficult to visualize the results of the Minnesota Experiment as a whole; but, on the other hand, it is of great value to compare results obtained under experimental conditions with observations made 'in the field' on undernourished populations. The kinds of foods which the subjects ate during the period of semi-starvation were those which the populations of France, Belgium and Holland were forced to live on during the War, and they were the foods which were most readily available in Germany during the period of greatest food shortage in 1946. Prof. Keys and his colleagues conclude that the changes they observed were due first and foremost to a deficiency of calories and not to any specific protein or vitamin deficiencies. This was exactly in accord with the conclusion of workers who had the opportunity of observing the undernourished peoples of Western Europe.

The second volume closes with a list of three thousand references which, the authors write in the introduction, they have consulted in the original. Even if all the authors shared equally in this task, it means that each of them must have read and abstracted at least six hundred papers. Little wonder that they acknowledge "the forbearance of their wives throughout the years of dedication of time and effort to the present work".

E. M. WIDDOWSON