

stand it, to have this invitation extended. The invitation was sent, but unfortunately, owing to the rate of exchange and the impoverishment of the nation, the Germans could not accept. One of the German professors told me it would cost him three fourths of his yearly salary to go to Edinburgh and return. In Edinburgh there was a group of public-spirited citizens who, casting aside all recollections of the horrors and sufferings of the recent war, men and women who had, I think in every instance, lost some immediate member of the family, as a result of the war, backed up this invitation to the Germans by sending a personal invitation to each German to be their house guest while in Edinburgh and furthermore a subscription was raised and three English pounds sent to each man.

Twenty-five came. I talked with many of them. I never saw a greater sense of deep appreciation exhibited by a group of men in my life. They told me they had been taken into the households of these people, had been given every courtesy, had been fed as they had not been fed in years, and I am sure that every one of these twenty-five men went back to their home land, to their classes, lecture halls and their students with warmer and deeper feelings for their former enemies than ever before, feelings that must through educational channels permeate deeply into civilian life. If these people in Edinburgh who had suffered so terribly as a result of this great conflict had breadth of human spirit enough to open their arms, take to their bosoms, into their houses, and have them break bread at their tables these representatives of their former enemies, forgetting all past offences and worshipping conjointly with these people at the shrine of that great science, physiology, how can we, thousands of miles away from the source of conflict, scarcely touched by the terrors of war, how can we, I say, consistently harbor in our hearts embittered feelings against a struggling people, struggling against a horrible self-inflicted blow. The magnanimity and humility and brotherly love exhibited at this great meeting of scientists showed me as never before that research knows no country. All are working for the best and for the advancement of mankind, and the infusion of the research spirit throughout our entire educational system can not, in my judgment, make except for a wider-visioned, better and more tolerant nation.

FRANCIS GANO BENEDICT

CARNEGIE INSTITUTION OF WASHINGTON,
BOSTON, MASS.

WHAT IS THE LARGER MEANING OF THE VITAMINE TYPE OF ACTION?

So recent, so startling and, in a way, so bewildering are the discoveries concerning substances which,

like vitamins and hormones, produce such astonishing results in proportion to the quantities involved that nobody, not even those to whom belongs the credit for making the discoveries, seems to have had time to consider very much how the substances tally with others much better known in their relation to the phenomena of living beings.

If we view the apparently certain dependence on vitaminic action of metabolism and of conception in sexual reproduction, two of the most basic of all life processes, in the light of the universally held tenet that all such processes involve the transformation of matter and energy, an extremely far-reaching question easily formulates itself: Does such dependence mean that organisms have no power to utilize physiologically the potential energies either of the substances of their own bodies or of the foreign substances ingested by them, except through the activation of these energies by substances more or less of the vitaminic type or by changes of external condition of some kind?

It certainly looks as though a conclusion of this sort is being forced upon us. But if such is the case it is hardly possible to avoid pushing the question on from the realm of physiology to that of psychology. Within the realm of psychology, or better of psychobiology, the phenomenon of stimulus and response, definitive for the whole of life, first presents itself for consideration alongside the type of action in question. And it is important to note that stimulus and response almost certainly constitute fundamentally one of those inseparable couplets, like time and space, which we are coming to see enter largely into the make-up of the universe.

Our question then forges ahead inevitably until it covers the whole range of phenomena from those connected with the reflex are fundamental to much of animal life, to those connected with the neural, muscular and glandular systems as represented in the highest brute and human animals.

One close-at-hand possible nexus between the stimulus and response type of phenomenon and the vitaminic type is furnished by the conditioned nature of the beginning of individual development from the germinal stage of all organisms that exist part of the time in this stage.

The evidence is now overwhelming that the germs of no organisms whatever are able to start by their own inherited energies on their developmental careers. Their potentialities must be activated by something external to themselves either by contacts with other bodies or by changes of condition of the surrounding bodies. The numberless researches of the modern period on fertilization point unequivocally to this conclusion. The major point of the whole matter here is more the powerlessness of latent energies to

actualize themselves than what particular activating influences may turn the trick.

How far, now, does this sort of thing hold in living nature? Is it possible that all organic stimulus without exception comes under this principle? Indeed may it not be that exactly what we mean by such a stimulus is an activation of potential energies of some kind possessed by the stimulated organism? It would undoubtedly be permissible to look, for example, on the energies of all muscles and glands, so far as these organs approximate complete quiescence in the living organism, as being in a state of potentiality and requiring their appropriate stimuli (typically nervous) to change them to the state of actuality.

And from this standpoint while heredity is not, indeed, a "mere abstraction," *i.e.*, something that "does not actually exist," as a few thoughtful biologists have pronounced it to be, yet it is a "mere potentiality." And since, like all other potentialities, it is powerless to actualize itself, the whole long series of activating stimuli, without which there is no development at all, stands forth as external or environic influences of great positiveness and importance. According to the questioning here being indulged in, it would seem to be quite wrong to assume, as we are inclined to, that the initial stimulus of fertilization is the only one necessary to accomplish the development of the individual.

Again, if this dependence of life processes on the activation of potentialities by external agencies is really as far-reaching as all signs indicate, the question of its meaning for the processes we call mental, psychic, spiritual, become urgent and almost staggering. For instance, what possibilities are held before us of removing finally all doubts as to the scope and real place of sense experience in human life? For one thing the obviously correlative facts of the complete immobility of the nervous mechanism and the very special and highly efficient mobility of the muscular mechanism strongly suggest that the former somehow embodies organic energy in the latent state, so far as animal activity is concerned, while the latter presents it in the active state. And specially significant in connection with the suggestion here made is the strong tendency in present-day psychobiology to look upon the two systems, the nervous and the muscular, as not really two systems, separate and independent, but as one system, the neuro-muscular, with two distinct parts.

Having pushed our questioning thus far with gleams of light all the way we are encouraged to go still further and ask whether the problem of consciousness itself stands any chance of being illuminated by the potentiality-actuality-activation principle.

Now any one who has given this problem much

attention is pretty likely to be reminded by this extension of our question of the theory propounded a few years ago by W. P. Montague that consciousness is energy in a latent state.

So far as I know there has never been anything presented which would correspond in the Montague theory to the activation phase everywhere implied in our questioning. But so far as it goes this theory is highly interesting from the standpoint of this note, especially if organic potentiality be not conceived as absolute inactivity but only as motor and translatory inactivity. Molecular, intracellular activity in any degree might be assumed and thus would fall in well with the high rate of metabolism observed in the brain.

The subject brought before us by these reflections is so vast that a communication like this can, of course, be nothing more than the barest touch upon its hem.

Even so, perhaps enough has been said to justify an attempted definition of a living animal creature that is rather strikingly different from the usual run of these attempts: Such a creature is a vastly complex organization of substances some of whose energies are always in the active state while others are in the latent state, the organization being such as to enable the creature constantly to alter more or less the relation between the two states of its energies in accordance with its needs, present and prospective; being able, in other words, to respond adaptively to the stimuli to which it is subject. •

Nor is the questioning upon which we are launched able to find a permanent resting-place on the high road from psychobiology to philosophy. For, be it noticed, if the "stimulus-response polarity" plays the basic part in all life that is strongly intimated, then are we humans part and parcel of the system of nature not only through the bonds of the substances and energies by which we act at all, but also through the bonds by which we act consciously and intelligently. And since the source of the stimuli which condition our conscious and intelligent lives is limitless in extent, so far as we know, literally and not figuratively do we "live, move and have our finite being" in a universe that appears to be infinite in both space and time.

WM. E. RITTER

YACHT "OHIO"

July 21, 1924

SCIENTIFIC EVENTS

A SOCIETY TO PROMOTE CULTURAL RELATIONS BETWEEN ENGLAND AND RUSSIA

A SOCIETY for Cultural Relations between the Peoples of the British Commonwealth and the Union