edly, because psychologists, including Ruckmick, are still burdened by a double allegiance, the one to acceptance of the present dispensation, the other to a continuance of the older tradition. A good deal of useless and outmoded luggage is still carried in the equipment of affective psychology.

This comment in turn raises another issue, namely, as to the value of this type of omnibus text-book. Teaching psychology has had a deleterious effect upon the psychologist's cerebrational processes. Carried far enough, it leads to giving psychological courses to enable others to give psychological courses to the increasing burden of future generations. This is good for the printers, bad for the forests and worse for psychological progress. To shift the reference, it leads to the further obscuring of the forest by the trees and makes on the student the impression of a collection of fallen leaves. The only salvation is a consistent logical interpretation. The reply of a distinguished scientist may be pertinently cited, when approached by a publisher desirous to conscript him as a text-book writer: that in regard to such an enterprise, his position was that of a conscientious objector. Ruckmick's book would have been a far better one had he not had the classroom so constantly in mind while writing it. The reforming note in pedagogy questions whether the student mind needs a special and synthetic diet, and believes that students—the minority who are studious as well as the majority who are not—thrive on the same nutritious, vitamin-rich food as nourishes the investigative spirit.

As a compendium of the research on emotion, the volume has a definite place. It is particularly strong on the experimental contributions: the internal somatic indications of affect, the psycho-galvanic (electrodermal) response, the technique for "metabolic" registry, for the facial, less so for the other gestural "filming" and for the internal psychic accompaniments. There are also chapters on pathological emotion, on emotion in the child and in animals—all compiled in the same interest. Nor do these chapters wholly lack the integration which is essential to their interpretation; but it is not carried as far as is desirable, nor organized as critically—to risk the odium of comparison—as is Boring's work for experimental psychology, and Gardner Murphy's for historical psychology. Perspective, guide-maps, critical interpretation—not summaries à la diaries—are as desirable for the professional reader as indispensable for the student. The devotion that spends years of labor upon a project should utilize the experience to the full; and the fruition of it all is in the mastery of its significance as one comprehensive problem.

The consummating privileges of the affective life, and the difficulties of its adequate presentation, lie in its vast scope; rooted in the elemental responses of neural protoplasm, it reaches to the maturation and ideation of human lives, the direction of future generations and the policies of nations. The story of affect comprises two great divisions: that of its foundations and that of its career under the expanding forces of culture—all psychological at root. Dr. Ruckmick's contribution is to the fundamentals mainly; the implications are indicated, but not carried through on a comparable scale. The first division lends itself to the techniques of science; the latter requires a different flair. It approaches a clinical view of humanity; which condition explains why Freud as psychoanalyst became an affectologist—too exclusively, an erotologist.

This dominant human interest likewise partly explains why the studies of affect ran to diffusion and confusion: they started too high up. As men are humans primarily and psychologists by secondary intent and training (or misfortune), they apperceived affect from a conning tower, not closely face to face with humble realities. That perspective has now been restored under the evolutionary principle, which recognizes in the present the active presence of the past, in the higher the surviving activity of the lower. The emotions remain a grand empire of human contemplation, a continuous epic of the human struggle to live by and yet beyond organic heredity. The super-psychologist, if ever he arrives, will come by the route of mastery of the vicissitudes of the affective life. The mystery of affect remains no less impressive than the mystery of intelligence.

JOSEPH JASTROW

SPECIAL ARTICLES

ENVIRONMENTAL CONDITIONS AND THE WASTING DISEASE OF EEL-GRASS

THE almost total disappearance of "eel-grass" (*Zostera marina*) from Atlantic waters during the years 1930–1932 may never be satisfactorily explained. In fact, some of the ablest biologists of my acquaintance already are relegating to the category of "things we shall never know" the cause of the recent scarcity of this native plant throughout its range along the coasts of both North America and Europe. The obscurity surrounding what many of us regard as the most interesting biological phenomenon of recent years makes it seem worth while to record for future reference any fragments of information which may be gathered or even any relevant suggestions as to possible causes.

APPARENT INADEQUACY OF SUGGESTED EXPLANATIONS

At least three dissimilar organisms have been reported as parasitic on eel-grass since 1931. That any one of these or all three together can be the ultimate cause of this catastrophe is not maintained by any investigator. Indeed, unless we assume that one or more of these supposed parasites was suddenly introduced into the North Atlantic Ocean (or arose there by mutation), we must look for the ultimate explanation of the phenomenon to changed environmental conditions which either directly caused the wasting of the eel-grass or made it possible for the various parasites to gain sudden and all but complete ascendency. This point of view was stressed by Sparrow and by Setchell[1] during a discussion of the problem at Amsterdam. The frequently observed fact that *Zostera marina* has, in general, persisted longest in regions close to the mouths of rivers where the sea water is most dilute would alone suggest that some change in the water was the basic cause of the wasting disease.

In searching for phenomena which may be related to this eel-grass scarcity it is necessary to exclude from consideration all which are purely local, since the eel-grass has shown the same diminution in Europe as in North America. It should be borne in mind, also, that the wasting of eel-grass is not an isolated phenomenon. Indeed, it was the fact that it coincided in time with the unprecedented northward extension of bacterial wilt of corn, which is in its turn apparently correlated with weather conditions, that first directed the writer's attention to the present study.[2]

PERIODICITY IN EEL-GRASS SCARCITY

Most of our information regarding the recent fluctuation in the amount of eel-grass on the Atlantic Coast of the United States is the result of field work by Clarence Cottam, of the Biological Survey, U. S. Department of Agriculture. Cottam[3] has also spent some time in the search of older records of eel-grass scarcity, on the basis of which he reports two such periods during the past 40 years. One is definitely dated by a printed record as including the year 1894 in Massachusetts and a second by a French printed record as including the year 1913 in France.

DECLINATION OF THE MOON

One of the surest ways to incur ridicule among scientists is to suggest a relation between some natural phenomenon and the moon. So strong is this feeling and of such long standing that it is of record that Galileo, in comment on Johann Kepler's suggestion that ocean tides were influenced by the moon, expressed regret that so acute a man should have produced a theory which seemed to reintroduce the occult.[4] With this clearly in mind, I am venturing to call attention to a correlation which if accidental is at least interesting. My friend and co-worker of many years, Dr. H. J. Franklin, has recently shown me in connection with a wholly different subject a curve of the northward declination of the moon (Fig. 1).

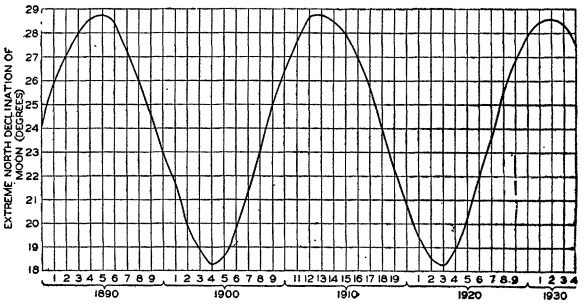

FIG. 1. Extreme north declination of moon. 1891–1934.

It will be noted that the three recorded periods of eel-grass scarcity in the North Atlantic all coincide with periods of extreme north declination of the moon. It would be as futile as it would be easy to labor this point, to suggest that extreme north declination may well be associated with changes in little-known sea currents which bring substances which weaken the Zostera, or even change the temperature beyond the narrow limits which Setchell[5] finds favorable for this plant. Before this relation is dismissed as a mere coincidence, attention should be called to the fact that the oceanographer Pettersson has developed a theory based on an extensive body of evidence regarding the possibility of regular periodicity in the ocean currents. As quoted by Harvey[6] he believes "that when the horizontal pull due to attraction towards the moon is at a maximum, the flux of the Gulf Stream is also at its highest. *This occurs every 18½ years when the moon's declination is least.* (Italics mine.)

TRANSGRESSIONS IN THE ATLANTIC OCEAN

An attempt to study a plant disease without considering the available evidence regarding environmental changes is almost foredoomed to be inadequate. In the case of Zostera, the environment is the coastal water of the North Atlantic Ocean and there is available some information regarding changes therein which may well have significance in relation to the wasting

[1] Proceedings of the Sixth International Botanical Congress, Amsterdam, Vol. 1: pp. 282–283, 1936.

[2] N. E. Stevens, *Plant Disease Reporter*, 18: 141–149, 1934.

[3] Clarence Cottam, *Rhodora*, 36: 261–264, July, 1934.

[4] Encyclopedia Britannica, Volume 26, p. 943, Edition of 1910.

[5] W. A. Setchell, SCIENCE, 56: 575–577, 1922.

[6] H. W. Harvey, "Biological Chemistry and Physics of Sea Water," Macmillan, 1928.

disease. This direct evidence relates chiefly to transgressions. A transgression is defined by Hachey[7] as "a periodic movement, of variable amplitude, of Atlantic waters of tropical origin, bringing a momentary encroachment of these waters upon the waters of polar origin and especially upon the continental waters."

A review of the available information regarding transgressions and related phenomena is readily available in the Proceedings of the North American Council on Fishery Investigations, 1921–1930, No. 1, Ottawa, 1931. This report relates directly to fisheries, and the changes in environment are discussed chiefly with reference to the abundance of fish, yet some of the observations are of interest. For example, "The year 1927 was a year of strong warm transgression. Its influence on the banks was disastrous, and it is still (1931) being felt. Since that date the equilibrium has not yet been re-established. . . . During the last four years the fishing operations carried on by sail boats have constantly decreased because cod have less and less been frequenting the shallow grounds, because these have been too seldom inhabitable."

In view of Setchell's theory regarding the importance of temperature on the abundance of eel-grass, it should be further noted: "One point already cleared up is that poor fishing seasons correspond to extensive warm transgressions, that is, to mass invasions of the banks by genuine Atlantic waters, whereas in normal years it is only the slope water, driven by the tropical waters, that conflicts there with the continental waters of polar origin."

There is a known rhythm both in the transgressions themselves and in the catch of fish which some students of the problem believe to be related to the changes in temperature brought about by the transgressions. Table 1, taken from page 46 of the report cited, is

TABLE 1
THE YIELD OF NEWFOUNDLAND FISHERIES GROUPED TO ELIMINATE AS FAR AS POSSIBLE THE INFLUENCE OF IMPROVED EQUIPMENT

Maxima ..		1887	1900–01	1910	1918	1926
Minima ..	1882	1893	1904–05	1913	1921	1929

intended to show the yield of Newfoundland fisheries so grouped as to eliminate to a large extent the influence of improved equipment. It is obvious that each alternate minimum, that is, 1893, 1913 and 1929, coincided with or just preceded a recorded period of eel-grass scarcity in the North Atlantic.

The same coincidence appears, of course, in relation to the transgressions—see 7, Fig. 1, which shows the magnitude and periodicity of the various components. Among others there is a "transgression with a period of 9¼ years and whose maximum occurred last in 1930." Transgressions of this period agree closely with the minima of yield of Newfoundland fisheries already noted. Each alternate transgression of this period, that is, those which coincide with the extreme north declination of the moon, 1894, 1912 and 1930, coincide closely with the recorded periods of eel-grass scarcity.

All this is, of course, highly speculative and based on mere fragments of evidence. On the other hand, is it not inherently much more probable that the wasting disease of eel-grass is related to some such environmental change than that it is caused by some recently introduced or created parasite? At least, it would appear well worth while to study the biology of eel-grass in relation to its environment during the probable period of increase through the next decade and especially during the next period of wasting, which is apparently due about 1949 or 1950.

NEIL E. STEVENS
UNIVERSITY OF ILLINOIS

[7] H. B. Hachey, SCIENCE, 83: 349–350, April 10, 1936.

REGARDING THE GENERAL NATURE OF CATHEPTIC ENZYMES

CATHEPSIN is a proteolytic enzyme found in many animal tissues and is representative of a group of proteolytic enzymes called "catheptic enzymes" or "papainases," since papain, the enzyme of the melon tree, is the oldest member of this group. The catheptic enzymes possess one significant property in common, namely, they may be activated by hydrocyanic acid, hydrogen sulfide, sulfhydril compounds (*i.e.*, glutathione) and many other substances.

The catheptic enzymes have been the subject of searching inquiry which has led to the following conclusions:

(1) Like pepsin and trypsin, the catheptic enzymes are supposed to attack only genuine proteins and high molecular weight degradation products of proteins. Little is known about the individual specificities of the catheptic enzymes, pepsin or trypsin. It is widely held that the specificity of these enzymes is adapted to substrates of high molecular weight.[1]

(2) The catheptic enzymes from various sources have been investigated with regard to their homogeneity and each one of them is supposed to contain only one protein-splitting enzyme.[2]

(3) Nearly all the activators have reducing properties. Furthermore, by moderate oxidation it is possible to inactivate active catheptic enzymes and to regenerate the activity by reduction. Several investigators concluded from these facts that the activation

[1] W. Grassmann and F. Schneider, *Ergebnisse der Enzymforschung,* 5: 79, 1936; C. Oppenheimer, "Die Fermente und ihre Wirkungen," The Hague, 1936.

[2] W. Grassmann, *Ergebnisse der Enzymforschung,* 1: 129, 1932; E. Waldschmidt-Leitz, A. Schäffner, J. J. Bek and E. Blum, *Zeits. Physiol. Chem.,* 188: 17, 1930.