Many explanations of these declines and extinctions have been offered—a few absurd, others plausible. Doubtless several causes were involved in the result. But whatever the cause may have been, it is evidently a law of nature that the career of each type and of each group must take the form of a rising and falling curve.

We now clearly understand that in the course of this rise and fall of species, genera, and larger groups, there has been a slow but steady increase in complexity of structure and in function, in both animal and plant bodies. The worm has been succeeded by the more highly constituted mollusk, which has in turn been supplanted by the arthropod, the fish, and finally the mammal.

Each animal type seems to embody an experiment to test the worth of one or more important new devices which are the distinctive contribution of that type to the progress of animal development.

The trilobites in the sea and the insects on land introduced the wholly coordinated nervous system and the power of rapid well-directed motion, with better seeing powers and even the possibility of flight in the air. These improvements represented a great advance over the corals, which wait helplessly for their food to drift into their mouths, or even over such worms, starfishes and mollusks as slowly grope through mud or sand or crawl with proverbial snail's pace over the surface. In a broad sense, the arthropods may be said to have introduced into the world the rapacious habit—the active pursuit of food.

Another advance was represented by the first vertebrates and particularly by the fishes, which have attained nearest to perfection of all water-inhabiting animals either previous or subsequent. They invented the spindle form and the stern propeller, both of which have been imitated necessarily by every successful swimming thing from the shark, the ichthyosaur and the porpoise to the modern submarine torpedo. The fishes also introduced the photographic or image-recording eye, which is far superior to the light-sensitive spots of certain echinoderms or even the remarkable compound eyes of the insects.

The reptiles in their turn devised the solid bony skeleton without which active life upon the dry land had previously been limited to small animals such as the insects. They introduced the encased egg, capable of being incubated in air instead of water. This placed the class one step ahead of the amphibians, which must always remain near water. The reptiles invented also a type of cover which was able to withstand the evaporation of the body liquids, without loss of that flexibility which was essential for rapid motion. They were not, however, so successful in coping with that other element of climate—temperature. The chill of winter reduced their bodily processes to inaction and obliged them to hibernate except in the warmer months in the year. For that reason they must always have been, as they are now, largely confined to the warmer parts of the globe.

The probable descendants of the reptiles—the mammals—somehow contrived that wonderful invention, warm blood, and with it the necessary heat-conserving cover of hair. These enabled the mammals to range over nearly all parts of the globe regardless of climatic and seasonal changes and to maintain their bodily activities constantly at the most favorable temperature by oxidizing carbohydrates as bodily fuel. It would be hard to overestimate the importance of this innovation.

(To be concluded)

ELIOT BLACKWELDER
HARVARD UNIVERSITY

ON THE DIFFERENTIAL EFFECTS OF THE INFLUENZA EPIDEMIC AMONG NATIVE PEOPLES OF THE PACIFIC ISLANDS

SINCE the influenza pandemic of 1917-1918, the writer has had occasion to make two journeys to insular areas of the Pacific Ocean, for the prosecution of special field-studies. In two specific instances, incidental observations were made on the differential effects of the imported disease upon the human inhabitants of certain islands; it is the object of the present brief communication to record the essential facts.

I. The first area is that of the Society

Islands, of which Tahiti is the largest and best-known member. The fundamental point is that the pure-blooded natives of this group of islands suffered a mortality which was reported to vary from fifteen to twenty-five per cent. in different circumscribed communities, while the half-caste population lost a distinctly smaller percentage; the white inhabitants lost very few of their numbers, thus manifesting a high natural resistance.

The disease was brought to Tahiti in November 1918 by a vessel from San Francisco, some of whose passengers had developed the malady after embarking. The vessel was released from quarantine, despite the protests of the medical officials, and within twenty-four hours the contagion had begun its rapid spread throughout Papeete, the main town of Tahiti. So far as the writer could ascertain by enquiries in the summer of 1919, the incidence of the epidemic was about the same for all of the three classes of the community, distinguished above. Very few failed to contract the disease. Many natives fled from Papeete to the remote districts of Tahiti and to the other islands, so that all parts of the group were affected.

It was impossible to secure exact quantitative data as to the numbers of deaths among the three divisions of the population, for the figures have not been compiled by the authorities; but the qualitative result stated above became clearer with each additional conversation with medical men and traders, and with numerous native chiefs and commoners. In every case, the questions were framed so as to elicit a statement without disclosing the point at issue; those who are familiar with native peoples will realize that this is a necessary precaution when seeking information. Without a single exception the statements agreed as to the essential facts.

Thus the natural resistance of the foreigners proved to be high, even under the adverse climatic conditions of the tropics, while the alien parentage of the half-castes gave to them a greater chance of survival as compared with the unmixed natives, among whose kind a prior process of selection had not occurred as among the nations of Europe and America.

2. The second instance is that of two different native peoples that exhibited an astounding difference in mortality when attacked by the same disease. In the summer of 1920 the writer visited the Mariana or Ladrone Islands, where most of the available time was devoted to field-work in Guam; an opportunity was seized, however, to spend a few days on the island of Saipan, which lies about 120 miles to the northward of Guam. The principal settlement of this island is the town of Garapan, where the population comprises about 1,500 Chamorros, or Mariana Islanders, and an approximately equal number of natives of the Caroline Islands. The two peoples occupy distinct divisions of Garapan on either side of a dividing road, and they remain essentially separate in culture, dress, language and matrimonial relations.

At this place the writer found a gifted Spanish Chamorro named Señor Gregorio Sablan, who was the teacher-missionary as well as the official interpreter. He described the coming of the influenza epidemic by means of a vessel from Japan about a year before, and he gave very definite accounts of its ravages. As everywhere else, practically all of the inhabitants contracted the disease. The percentage of deaths among the Chamorros of Saipan was in excess of twelve per cent., while among the Caroline Islanders, equal in total number, the deaths were stated to have been *only six, or about four-tenths of one per cent.*

Clearly, then, the latter people displayed a degree of resistance to the pandemic that is astonishingly high in comparison with that of all of the other islanders which the writer personally observed. The circumstances in Garapan are such as to bring out this fact most sharply, because the two contrasted groups of natives lived in the same community under practically identical conditions of housing and regimen. Only in the matter of dress was there an obvious difference. The Chamorros clothe the body completely, after the manner of the Filipinos, while among the Carolinians the men are naked save for a small loin cloth, and the women wear a fiber mat, or length of cloth, around the body from the waist to the

knees. It is at least conceivable that the differences in such respects might affect the temperature reactions of the body during fever, more advantageously in the case of those with less clothing. But if this is the explanation in the particular instance under consideration, it does not seem to hold in others; the Melanesians to whom the disease was brought suffered as greatly as the Chamorros and Tahitians, according to reports, although they cover the body at least as little as do the Caroline Islanders. Whatever the explanation of the Saipan observations, the fact remains that the two contrasted peoples differed greatly in their mortality; in the absence of any distinguishable external factors, their difference is most reasonably to be attributed to constitutional peculiarities.

HENRY E. CRAMPTON

BARNARD COLLEGE,
COLUMBIA UNIVERSITY,
DECEMBER 24, 1921.

PRESENTATION TO PROFESSOR EMERSON

THIS society has come at last to the fountainhead of American geology—Amherst College. Nearly a century ago, while Amos Eaton was inspiring students at the Rensselaer School by his novel modes of teaching, and Silliman the greater, at Yale, was illuminating the facts and fancies of this science by his brilliant and fascinating deliveries, Edward Hitchcock was actually creating a geological survey of this Commonwealth of Massachusetts and initiating classes of students into the astonishing revelations and practical applications of a new science. It was a difficult field he found here in this Connecticut Valley and its complicated uplands; many different categories of geological facts crowded upon him, but he interpreted them with clarity and with such degree of distinction that he was, in due course, selected by Governor Marcy of New York as the first state geologist for that well organized survey; an appointment which he accepted, entered upon but soon abandoned because that field was too far away from Amherst College —indeed, reason in plenty!

Let us remind ourselves that Edward Hitchcock was a distinguished divine, professor of natural theology and geology and president of this college, in the most uplifting days of the last century. This minister of the gospel was boldly entering upon paths lined with harvest fields of truth which to his contemporaries were fields of poison weeds. With equanimity he faced the bigotry of common ignorance and the theological odium; but his students heard and followed him gladly into those days of delightful and romantic adventure over this countryside, when every hill and knoll, each stream and gully, each glacial boulder and picturesque retreat was baptized by the geologist-president and his classes, with ceremonies of address and poem and song: Mounts Castor and Pollux, Mount Pleasant and Mount Pleasanter, Mettawampe and Aquilo, the Crescent, the Occident, the glacial stones Rock Rimmon, Rock Oreb, Rock Etam, and so on through a long list of natural monuments; names which should never be permitted to disappear from the map of Massachusetts, for they are storied monuments not only of her science and her scenery but of one of her great sons.

If I pay thus brief tribute to the eminent Hitchcock, it is only to intimate the influence which helped to mould this other great teacher of our science to whom we are come tonight with our hearts in our hands. Professor Emerson has grasped the very horns of the altar of this science, and as we consider wherein has lain his glowing success as a teacher, let us remember the atmosphere he breathed here in his student days. It was an atmosphere sweetened by the fragrance of a science just bursting into flower, tinged with joyous and natural emotions, but never robbed of its spirit of devotion. Teachers are the personifications of immortality. The men whom Emerson trained, and who have arisen one by one to their own niches in the science, sent out in

[1] Address of presentation to Professor Benjamin Kendall Emerson, LL.D., of Amherst College, at the annual meeting of the Geological Society of America, at Amherst, December 29, 1921.