Rhythmic variation.

It is a general axiom in 'breeding' and in allied biological discussions, that 'like produces like;' and yet in nature, or under art, we have no instance we can use where like has produced an identical likeness. It rather seems that the practical expression should be the converse one, that 'variation produces variation;' for in nature we find variation the general fact, no animal and no plant producing offspring precisely similar to itself. Indeed, as the attribute of life is motion and but momentary equilibrium between internal and external forces, we may consider variation as an empirical law of nature, and as influenced by the law of rhythm, as outlined by Herbert Spencer, who says that rhythm results wherever there is a conflict of forces not in equilibrium.

This law of rhythm seems sufficient to explain, in part or in whole, some of the variations observed in species, and for which neither natural nor sexual selection can account. Given organisms under similar environment, and remote from selective opportunity, we must believe that variations must occur; and these variations must naturally become grouped about types under the action of heredity and some other general laws, giving through rhythmic action the appearance of progressive development.

Probably this law of rhythmic movement may explain the interesting variations which have originated species in certain protoplasmic organisms, as so well described by Professor Asa Gray (*Amer. journ. sc.*, April, 1884, 327), who says, —

"No exercise of 'natural selection' could produce the successive changes presented in the evolutionary history of the typical Orbitolites, from Cornospira to Spiroloculina, from Spiroloculina to Peneroplis, from Peneroplis to Orbiculina, from Orbiculina to the 'simple' forms of Orbitolites, and from the 'simple' to the 'complex' forms of the last-named type. And as all these earlier forms still flourish under conditions which (so far as can be ascertained) are precisely the same, there is no ground to believe that any one of them is better fitted to survive than another. They all imbibe their nourishment in the same mode, and no one type has more power of going in search of it than another. That they are all dependent on essentially the same conditions of temperature and depth of water, is shown by their occurrence in the same marine areas. That they all equally serve as food to larger marine animals, can scarcely be doubted; and it is hardly conceivable that any of their devourers would discriminate (for example) between the disks of a large O. marginalis, or middle-sized O. duplex, and a small O. complanata, which even the trained eye of the naturalist cannot distinguish without the assistance of a magnifying-glass."

E. LEWIS STURTEVANT.

Geneva, N.Y., April 12.

Rare Vermont birds.

In a list of birds given under this heading in No. 55 of *Science*, appeared the American avocet (Recurvirostra americana Gm.) and orange-crowned warbler (Helminthophaga celata Say, Bd.). It appears, these were admitted on mistaken evidence, and are not to be considered as Vermont birds.

FRANCIS H. HERRICK.

THE APRIL SESSION OF THE NATIONAL ACADEMY OF SCIENCES.

THE number of papers presented at the session of the National academy of sciences in Washington last week was less than usual, and, judging from the discussions, none were of commanding interest and importance. An unusual number of prominent members were absent from the meeting; and it also happened that the social re-unions which have usually accompanied the annual session were, from various accidental circumstances, omitted. It has long been a custom, if not an unwritten law, of the academy, to decline all social attentions which do not come either from members or officers of the academy, or from heads of government departments interested in its work.

An interesting feature of the meeting was a communication received from Mrs. J. Lawrence Smith, widow of the late lamented chemist of Louisville, proposing to give the sum of eight thousand dollars, which she had received from Harvard college by the sale of Professor Smith's collection of meteorites, to establish a memorial fund for the promotion of meteoric research. The academy will then have four considerable funds for the promotion of science, — the Bache, Draper, Watson, and Smith funds.

The following were some of the more interesting of the physical papers: —

It has long been a well-known result of theoretical mechanics, that the rotation of the earth causes a slight tendency in any southward-flowing river of the northern hemisphere to press towards its right bank; and various phenomena have been attributed to this, among others a supposed tendency of driftwood to accumulate on the right rather than on the left bank. It is, however, readily shown that this tendency could not produce this effect; and the general conclusion has been, that the only effect would be an imperceptible difference of level of the two sides of the river. The object of the first paper read — that of Mr. Gilbert, on the deflection of river-courses in consequence of terrestrial rotation — was to point out an indirect result of the forces in question, which had hitherto been overlooked, and which might produce observable results. He showed that the effect of terrestrial rotation is to increase the centrifugal force on those curves which deflect the river from the right towards the left, and to diminish the force in the opposite direction; the difference in the case of the Mississippi River being about one-tenth part of the whole.

In his paper on the origin of crystalline rocks, Dr. Sterry Hunt conceived that rocks, like gneiss and other felspathic, hornblendic, and quartzose aggregates, resulted from the action of water on the superficial and last congealed part of the earth's crust, through upward lixiviation. The separation of zeolites and quartz from basic rocks is a survival of this process of deposition from mineral springs, whose action divided the primitive rock into a lower basic and an upper acidic portion. The author distinguishes this by the name of the crinitic hypothesis.

In continuation of the series of researches which he has been making upon solar and terrestrial radiation, Professor Langley presented a short paper on the character of the heat radiated from the soil. It is a commonly accepted opinion, that the atmosphere is less transparent to the invisible heat-rays of the sun than to the visible light-rays, and that the heat stored in the atmosphere is due to this cause. His researches had, however, shown, that, so far as solar radiation is concerned, this view was ill founded, since the solar rays of longest wave-length pass as freely through the atmosphere as the visible red rays. But, when the radiation from a metallic surface heated to the temperature of boiling water was measured, rays were found of a wave-length far exceeding any that had been measured in the solar spectrum. As it could not be considered probable that such rays were really wanting in the heat emitted by the sun, he reached the conclusion that they were absorbed by the atmosphere, which should therefore be regarded as opaque to such rays. This being the case, all or nearly all the heat radiated by the soil would be intercepted by the atmosphere; and thus we have the heat-storing effect to which the temperature of our globe is to be attributed. Incidentally Professor Langley expressed his entire dissent from the conclusion of Herschel and Ross respecting the heat radiated by the moon. The latter had attempted to differentiate the heat reflected by the moon from that radiated, and to determine the latter, and thus reach a conclusion respecting the temperature of the lunar surface. The conclusion of Professor Langley's researches was, that the heat radiated by the moon could no more penetrate our atmosphere, so as to be absorbed on the earth's surface, than it could penetrate the armor of a ship of war, and that its supposed measure must therefore be illusory. He also expressed the opinion, that the temperature of the moon under the influence of the full radiation of the sun, instead of being several hundred degrees Fahrenheit, as Herschel had supposed, was more likely very far below the lowest known on our globe.

Dr. Hilgard made a communication on the depth of the western part of the Atlantic Ocean and Gulf of Mexico with respect to the Gulf Stream. His remarks were illustrated by a model in relief, showing the configuration of the whole country east of the Mississippi River, and of the bottom of the Atlantic Ocean and Gulf of Mexico. The very slow rate at which the depth of the ocean diminished until the Gulf Stream was reached, and the rapidity with which it then shelved off, were very strikingly shown by the model. Dr. Hilgard also gave an account of the progress of the work of the coast-survey in connecting the Atlantic and Pacific coasts and the Gulf of Mexico by precise levellings. The work has been in charge of a single assistant, and has been carried 1,784 kilometres from New York, past St. Louis. The datum-point at St. Louis has been determined to be 126.91 metres above mean sea-level at Sandy Hook, with a probable error of 48 millimetres. By three sets of levellings, which have been made by different parties in the Mississippi valley, from St. Louis to the Gulf, and which are, in part, of unknown value, it would appear that the mean sea-level of the Gulf at New Orleans was one metre higher than that of the Atlantic Ocean at Sandy Hook, — a difference deemed probably greater than fact.

Mr. H. M. Paul of the naval observatory read a short paper on the Krakatoa atmospheric waves. He had made a copy of the curves of atmospheric pressure on the days in question, as registered at the signal-office in Washington, and reached conclusions similar to those of Gen. Strachey and others. He also showed that waves of the same kind had been recorded at other times on the register.

Several of the papers presented on the biological side were the direct result of the explorations of the U. S. fish-commission steamer Albatross. One of more than usual general interest was that of Prof. A. E. Verrill, who gave an account of some of the zoölogical results of the deep-sea dredgings between Cape Hatteras and Nova Scotia, using the model exhibited by Dr. Hilgard to illustrate his remarks. The number of additions to our fauna was surprising, including many new family and generic types in fishes, crustaceans, mollusks, echinoderms, and other of the lower invertebrates, and many whose nearest allies were inhabitants of distant seas. The dredgings were from two thousand to three thousand fathoms.

Dr. Gill and Mr. Ryder's paper on the Lyomeri exposed the characters of an extraordinary type of deep-sea teleost fishes, having, among other characteristics, no branchiostegal and pharyngeal, and only rudimentary branchial arches; an imperfectly ossified cranium; only two cephalic arches, — a maxillary and a suspensorial; no palatopterygoid and an imperfect scapular arch. The remarkable deviations from the ordinary fish-type can be explained on teleological grounds. The enormous development of the jaws throws the branchial apparatus out of place, and entails its eventual degradation. The peculiar construction of the mouth, and opposability of the jaws, appear to be correlated with selection for food, which seems to consist principally of globigerinae and copepods, which are doubtless restrained from escape, with the water ejected from the mouth, by the structures functioning as pockets and whalebone.

Another paper, largely based on the work of the Albatross, was that of Dr. Gill on the ichthyological peculiarities of the Bassalian realm, as he has proposed to call the deep-sea region. His views, which are at direct variance from those of Dr. Günther, based on the study of the Challenger material, will be given in some detail in an early number of *Science*.

In his paper on mastodons, read by Dr. Gill, Prof. E. D. Cope claimed that ten species were known from North America, of which no less than eight flourished during the Puerco period.

Dr. J. S. Billings, through Major Powell, suggested a new method of studying crania by means of composite photography, and exhibited some very interesting prints taken in illustration, on each of which seven adults of the same race and sex were shown from in front, in profile, and from beneath. Sioux, Eskimo, and Hawaiian-Islanders were the races chosen; and the method seemed capable of wide application with good results.

President E. M. Gallaudet read a paper on the 'combined system' of teaching the deaf, which he illustrated by one of his pupils, who could answer questions put to him with considerable distinctness. The speaker was not, however, of opinion that the use of the manual system could be entirely dispensed with, and characterized as a fallacy the views supposed to be held by another school, — that because some deaf had been taught to speak by lip instruction, therefore all could be so taught. The system which Dr. Gallaudet prefers, he would probably consider an eclectic one, applying to each case the method best adapted to it.

The following gentlemen were elected members of the academy: Profs. E. S. Dana and Sydney I. Smith of Yale college, Gen. C. B. Comstock of the corps of engineers, Dr. W. K. Brooks of Johns Hopkins university, and Capt. C. E. Dutton of the U. S. geological survey.

The autumn session of the academy will be held in October, at Newport, R.I.

AN ARCTIC VESSEL AND HER EQUIPMENT.

A GOOD portion of the science of navigation is devoted to the subject of safety. In navigation in the ice, that object is increased tenfold in importance, and overshadows all others. In the history of the different arctic voyages, whether for popular reading or for scientific report, this question of safety has generally been considered only so far as that particular voyage had any thing interesting or useful to suggest as a result of its own adventures. While it is not hoped in this article to add any thing to our previous stock of knowledge, still it is possible, that by bringing together a statement of various dangers and difficulties to be met, and the methods which have been employed to overcome them, its publication will aid in an understanding of this often talked of arctic voyaging.

The subject of ice-navigation embraces the construction of ships for this peculiar employment, or the altering for it of those that have seen less severe service; their management under the various combinations of ice-packs, ice-floes, icebergs, tides, storms, currents, and every obstacle of the frigid zone; their care and preservation in the ice during the arctic winter; and their liberation from this ice when the summer will allow them to begin again their experience as they prosecute their journey on or homewards.

I will not dwell upon such indubitable facts as the quality of the ship's material, which it is evident must be of the very best, be it wood or iron, or the almost equally apparent fact of the superiority of a vessel specially constructed for this purpose, by the hands of proper persons who have had experience in arctic navigation as well as naval construction, over the reconstructed merchantman or even stronger built man-of-war. The superiority of iron ships over those of wood no longer holds in the Arctic. The rapid conductive power of the former makes it almost impossible to keep an equable temperature without a thick inside coating of some non-conductor, besides the more rapid formation of frosts from condensed moistures along the outer sides of the bunks, causing serious diseases, and greatly aiding the propagation of that most terrible of all arctic scourges, the scurvy. The superior strength and endurance of iron over wood, in the usual accidents of the temperate and tropical seas, seem to be lost when the test comes in the shape of severe pressure from the ice; the elasticity of the wood allowing it to return to its original shape after an almost indefinite