food analysis, and to Dr. V. Mosquera Ferrés, who will be director of the department of pathology and diagnosis.

THE Trustees of Oberlin College recently awarded contracts for the construction of a Physics Laboratory. This is one unit of a proposed science quadrangle. A second unit, a Biology Laboratory, is in early prospect. The structural steel for both units was purchased some months ago and is on the ground. The quadrangle will be "anchored" to the present Chemistry Laboratory, chemistry being the only science at present in permanent quarters. On July 22 President Wilkins and Professor Taylor shared the ceremony of breaking ground for the physics unit, the construction of which is now under way. The laboratory will cover a space 59×194 feet and will consist of two floors and basement. The estimated cost of the building and its furnishings is $390,000. The architect is Edward J. Schulte, of Cincinnati. Besides unusually thorough provisions, designed under the direction of Professor C. E. Howe, for electrical distribution to student positions throughout the laboratory, this unit will house a well-equipped instrument shop, including glass-blowing facilities, serving all the science departments of the college.

CONDITIONS in Russia prevented the attendance of any Russian delegates at the International Congress of Genetics held in Edinburgh in August, 1939. According to *The Journal of Heredity* up to the last minute it was expected that there would be a considerable Russian delegation at the congress. The papers or abstracts submitted by the Russian delegates were on file with the Secretariat of the congress at the time it was held. Since these papers were not read by the authors they were not included in the proceedings, which have recently been published. It is the wish of many of the Russian workers that these papers somehow be made available as a matter of permanent record. The papers dealing with Drosophila are being issued by the Drosophila Information Service and thus will be available. Through the instrumentality of the American Documentation Institute the other contributions are being afforded supplemental publication so that genetic workers can obtain them as microfilms or as photoprints.

DISCUSSION

MEAN SEA-LEVEL AND SAND MOVEMENTS

A RELATION between mean sea-level and the height of sand along the pier at the Scripps Institution of Oceanography at La Jolla, Calif., was shown by La Fond.[1] He stated: "It should not be concluded that the rise in sea-level alone causes a building up of the sand, but many of the factors which influence the sea-level must likewise affect the sand movements." The conclusion that the rise in sea-level in any way causes the change in sand level can not be sustained; however, the factors which cause the changes in sea-level likewise change the shore-line shape so that a retreat or advance of the mean high-tide line (used for convenient reference only) will appear as a depth change along a fixed reference line, such as the La Jolla pier, where accurate measurements of position are easily made.

Fig. 1 shows the height of mean sea-level on the La Jolla tide staff, and the average height of the sand at fifty equally spaced stations along the pier. The data of La Fond are not included; the additional data were furnished by Dr. H. U. Sverdrup, director of Scripps Institution of Oceanography.

The flow of water past a headland projecting into the stream will induce an eddy current to form in the bight in the lee of the headland, causing the shore-line to take the form of a logarithmic spiral.[2] When sea-level is high along the Pacific Coast of the United States, it is low along the South American coast, necessitating an interchange of water between the hemispheres. Upwelling and prevailing winds also influence currents.[3]

The shore-line shapes resulting from current reversals will then be similar to those shown in Figs. 2A and 2B; when those two forms are superimposed, as in Fig. 2C, the retreat and advance of the high-water lines become apparent. La Jolla is situated in a position similar to the area marked "X." Had simultaneous observations been taken at position "Z," an increase in the sand height would have been noted during the *fall* in the sea-level height, while in the vicinity of "Y" no change in sand height would have been found, other than minor oscillations. This can be shown more easily by a survey of the shore-line in the bight during March and another in September, accurately locating a particular contour near the high-water line.

The seasonal travel of sand between the rocky headlands which form the California coast has long been observed, although no adequate explanation has been given. However, competent observers have noted the summer and winter oscillations and have concluded that but little sand passes the headlands, the quantity on each section of beach remaining approximately constant, recognizing that stream additions of sand occur in some bights and wind denudations in others. This view is reached by examination of the rock

[1] Eugena La Fond, SCIENCE, July 29, 1938.

[2] Harry Leypoldt, *Shore and Beach*, January, 1941.

[3] *Ibid.*, *U. S. Naval Institute Proceedings*, May, 1939.

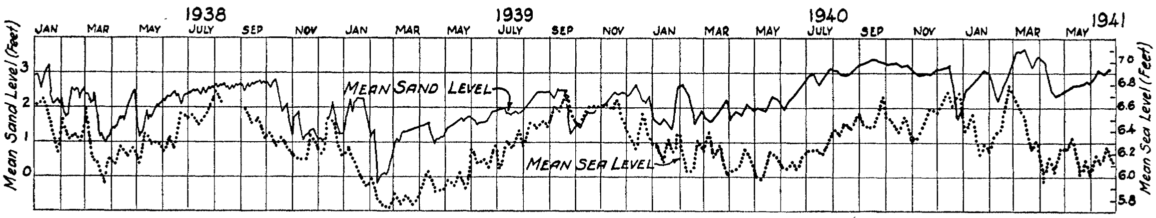

Fig. 1. Relation between mean sea-level on tide staff at La Jolla, California, and mean sand level along Scripps Institution pier, above arbitrary datum.

formations at the headlands. These retain sharp definition. Passage of large quantities of sand in either direction would quickly smooth the rocks. Also, the rocky points are usually heavily covered by kelp beds close inshore which grow on roots firmly anchored to a rocky bottom, precluding the possibility of sandy bottom at these points, therefore the passage of sand thereover.

The shorter periodical reversals of currents, caused by upwelling, winds and tides, also will move the shore-line to and fro, with the resulting change in sand height, accounting for the shorter period changes. Grant and Shepard[4] discussed the data of La Fond and others but reached the erroneous conclusion that the sand moved "onshore and offshore by waves of oscillation when they get into shallow water." They also stated: "During the winter stormy period the material is shifted out from the foreshore and deposited on the sea floor along the outer portion of the pier. In the summer the material creeps back to the foreshore." No attempt is made to explain this bizarre action of the sand "creeping back to the foreshore in the summer" or how an offshore component sufficient to carry sand offshore for a thousand feet or more is introduced into the waves of oscillation, practically all of which approach the beach from seaward. Similarly vague was the discussion of the current reversal cause.

"Observations at the Scripps pier show that a current ranging up to 2,000 feet per hour runs along the shore. This current frequently reverses its direction *because of local conditions*" (italics mine).

The effort to explain the phenomenon by introducing undiscovered and probably non-existent forces which cause a sand movement on and off-shore (normal to the shore-line), when the well-known lateral sand movements as shown herein amply cover the situation, is unwarranted and unsound.

From the foregoing, it is apparent that the sand height is not a function of the sea-level height. The former is dependent upon the littoral current direction and the shoreline-shaping tendencies of induced eddies, while the current is a function of several factors, one of which is the height of local sea-level in relation to the sea-level height in other portions of the same oceanic basins. Sea-level heights are functions of rainfall in the locality, together with river discharge and other methods of ground-water return, and water removal for rainfall.

The only conclusion which can be drawn from the

[4] U. S. Grant and F. P. Shepard, *Proceedings of the Sixth Pacific Science Congress*, 1939.

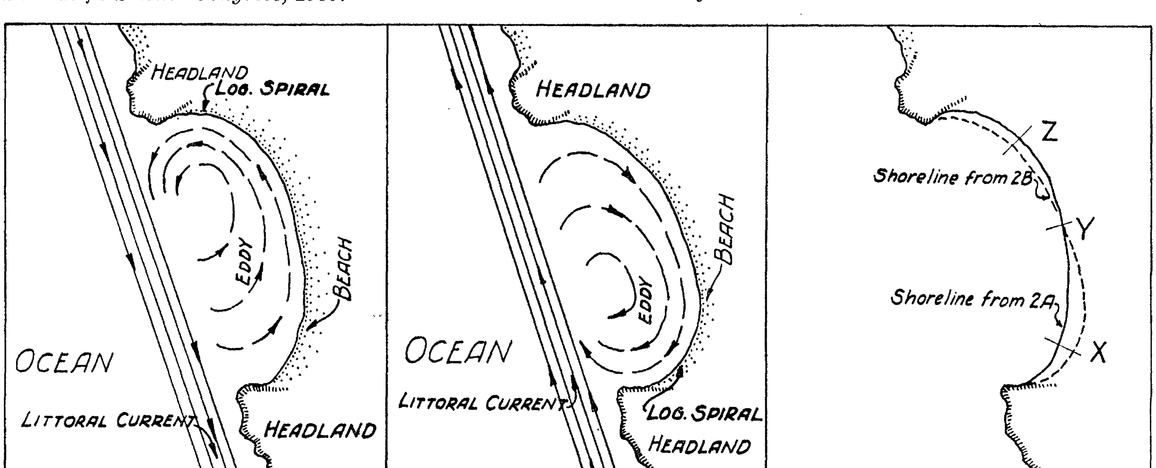

Fig. 2. Shore-line changes from reversal of littoral currents.

sand movements is that a reversal of littoral currents is generally reflected in a consistent change in sea-level height without indicating the relation which probably exists between sea-level and currents.

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ZIPF'S "LAW OF URBAN CONCENTRATION"

IN the August 15th issue of SCIENCE, Alfred J. Lotka points out that the law of urban concentration described by G. K. Zipf in his recent book, "National Unity and Disunity," is not particularly striking and at least not novel, citing a number of cases where the type of frequency distribution utilized by Zipf has been found applicable but where such application has thrown little light upon the relevant functional relationships.

It should also be pointed out that Zipf has attempted to apply the harmonic series frequency law to the frequency distributions of words in English, German, and several other languages.[1] Here, too, Zipf's work was foreshadowed, *viz.*, by E. V. Condon's article, "Statistics of Vocabulary."[2] Though Condon was not able to utilize the empirical data available to Zipf, his mathematical formulation was as adequate as that of Zipf. It is well to note, however, that the harmonic series law has a semblance of good fit to linguistic data only in selected cases—generally where the samples of words are of moderate size (not over, say, 100,000 words) and are taken from written material such as newspapers, books, etc. I have tried without success to apply the law to distributions of words in telephone conversations,[3] in children's speech and in stories written for children.

Finally, I wish to draw attention to a certain mathematical limitation to the application of the harmonic series law. This limitation has been discussed by me previously[4] and can be shown to apply to Zipf's latest contribution. We may first regard the population of an area as analogous to the number of words in a sample (N) and the number of cities, towns and villages in an area as analogous to the number of different words in a sample (d). We may then write Zipf's law as $fr^x = \frac{N}{k}$, where f denotes frequency (analogously, population of a city, town or village), r denotes rank, and k and x are parameters. As shown in my article, the harmonic series law can not hold for a sample where $N > dk$, at least where $x = 1.00$.

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[1] "The Psycho-Biology of Language," Boston, 1935.
[2] SCIENCE, 67: 300, 1928.
[3] N. R. French, C. W. Carter, Jr., and W. Koenig, Jr., *Bell System Technical Journal*, 9: 290–324, 1930.
[4] J. B. Carroll, *Psychol. Record*, 2: 379–386, 1938.

"THE BREATHING MECHANISM OF TURTLES"

THE discussion of turtle breathing by Dr. Hansen in a recent issue of SCIENCE[1] expresses justifiable impatience with a perpetuation of error by modern text-books. My reaction to the conflicting statements from different sources about this subject led me in 1939 to start an investigation of turtle respiration using physiological technics. This work is progressing and a report should soon be possible.

It should be pointed out, however, that although the sources quoted by Dr. Hansen—especially the splendid morphological study and deductions of Mitchell and Morehouse, who *appeared* to have settled the question as early as 1863 with little recourse to experimental work—seem to make his own observations a reemphasis of fact from the last century, actually the case is not at rest. Those who talk of throat movements in turtles as breathing action can support their statements by contemporary experimental data. For example, Lüdicke[2] in 1936 appears to arrive at the compromise conclusion that the difference between land turtles (Testudo) and aquatic (Emys) is that aquatic types swallow air and land types can not. He made observations, like Dr. Hansen's, of cannulized tracheae and collapse of lungs upon opening the body cavity.

My results with an equally aquatic species (*Malaclemys centrata*—diamondback terrapin) do not agree with Lüdicke's. A presentation of experimental evidence and attempts to reconcile conflicting observations can not be done in this comment. I concur in the essential point (but not in his details) of Dr. Hansen's discussion. The primary breathing mechanism in turtles is the movement of muscular diaphragms located at each leg pocket in the shell and ventral to the viscera, together with the muscular closure of the opening in the glottis.

Present writers of text-books who discuss turtle respiration will need to deal with the striking, and misleading, hyoid movements. They appear from records now on hand to be definitely correlated with sensory rather than respiratory functions, and they are almost certainly olfactory.

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[1] Ira B. Hansen, SCIENCE, 94: 64, 1941.
[2] M. Lüdicke, *Zool. Jahrb. Abt. Allg. Zool. u. Physiol.*, 56: 83–106, 1936.

ON THE OCCURRENCE OF STEREOISOMERIC CAROTENOIDS IN NATURE

IT was reported recently[1] that the ripe fruits of the Tangerine tomato (a variety of *Lycopersicum*

[1] L. Zechmeister, A. L. LeRosen, F. W. Went and L. Pauling, *Proc. Nat. Acad. Sciences*, 27: 468, 1941.