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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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] Ira B. Hansen, SCIENCE, 94: 64, 1941.
[2] M. Lüdicke, *Zool. Jahrb. Abt. Allg. Zool. u. Physiol.*, 56: 83–106, 1936.
[1] L. Zechmeister, A. L. LeRosen, F. W. Went and L. Pauling, *Proc. Nat. Acad. Sciences*, 27: 468, 1941.

esculentum) contain a new carotenoid, prolycopene, $C_{40}H_{56}$, which on treatment with iodine is rapidly converted into a pigment mixture in which lycopene, the red pigment of the ordinary tomato fruit, predominates. Whereas lycopene possesses the trans configuration throughout, all or most of the double bonds which are available for stereochemical changes are present in their cis form in prolycopene.

Assuming that representatives of the new class of carotenoids are wide-spread in nature, even though their quantity may be small, we tested a series of plant materials in this respect. It was found that a new carotenoid occurs in some palm fruits, *viz., Butia eriospatha* and *B. capitata* (Becc.). It can be crystallized and shows in petroleum ether absorption maxima at 462 and 432.5 mμ. On addition of some iodine to the solution contained in a spectroscopic cell, the typical three-banded spectrum of γ-carotene appears almost immediately. The maxima are now at 493.5, 461 and 431 mμ. They have somewhat shorter wave-lengths than pure γ-carotene (495, 461.5 and 433.5 mμ) due to the presence of subsidiary stereoisomers. The new pigment has been termed *pro-γ-carotene.* In *B. capitata* it is accompanied by prolycopene from which it can easily be separated on the chromatographic column.

The fruits of *Pyracantha angustifolia* (Schneid.) contain pro-γ-carotene and at least two different prolycopenes.

Further experiments now in progress in this laboratory may reveal other examples of the occurrence of such carotenoids which are stereochemically different from representatives of the well-known all-trans series.

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SPECIAL CORRESPONDENCE

LETTER FROM DOUGLAS COCKERELL, LETCHWORTH, ENGLAND, OCTOBER 1, TO HIS BROTHER IN COLORADO

THE three-day meeting of the British Association in London has been a notable event. A. Huxley describes it as being the most important scientific meeting ever held. A lot of wise things were said by important people bearing on the function of science in the reconstruction after the war. A sort of "Atlantic charter" for science was promulgated, emphasizing the unity of science throughout the world in spite of racial and political divisions. It was stated that now for the first time we had a provisional standard of the minimum requirement in food to produce the maximum health, and that some three fifths of the people of the world were living below this standard, so we had a very definite aim in front of us. Altogether, as might have been expected from a body of scientists drawn from all over the world, a larger view of world problems was taken than we have had from our politicians.

I have been reading an account of a fanatical sect that existed in the midlands in the early part of the nineteenth century. They were convinced that the end of the world was imminent, and so took no consideration for the future, living from hand to mouth from day to day.

I notice a somewhat similar state of mind developing in connection with the war conditions. The future is so uncertain. I don't think that there is any fear of the country being conquered, but there is great uncertainty about what the conditions will be after the war, particularly about the value of money. People generally are, I think, in a mood to face and accept great changes if these are ably advocated; wise leadership is what is wanted, and the British Association meeting, by lifting the world problems out of narrow nationalistic grooves, may have a far-reaching effect on world opinion. Anyway it seems to have set a standard to be aimed at, and the political and diplomatical people appeared to agree with the suggestions put forward. The churches, too, are stirring, and taking a much wider view, and there is a marked revival of religious feeling, and a groping for some sort of guidance quite beyond the dogmas of the different sects.

Something great may come out of all this, but at present all seems to be in solution, and what will precipitate out we can not tell.

In the meantime we live on from day to day, not unhappily, but in a fog of uncertainty about the future.

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POST-GRADUATE COURSE IN TROPICAL MEDICINE AT TULANE UNIVERSITY, 1941–1942

DURING the first half of the academic year 1941–1942 a comprehensive post-graduate course in tropical medicine has been conducted at Tulane University under the auspices of the department of graduate medicine. There are seventeen enrollees, including nine from Latin-America, seven from the United States and one from Canada. Of the Latin-American group two are from Brazil, one from Chile, one from Colombia,