well founded that there is room for alternative superstructures beside that which Chamberlin here presents.

The previous paragraph has dealt with alternative possibilities; on page 178, however, an erroneous diagram of stress-differences due to the weight of second harmonic inequalities is taken from G. H. Darwin. The original paper was published in 1882. About a year later Charles Chree pointed out an error in Darwin's procedure which led Darwin to publish a correction in 1885. The correct solution is given in Darwin's Scientific Papers, Vol. II., pp. 459–481, 1908. The erroneous diagram indicates a tidal force eight times greater at the center than at the surface. A corrected diagram would show the tidal stress at the poles, on the equator, and at the center in the ratio of one to three and eight. On the equatorial surface the stress due to either tides or to lack of adjustment between oblateness and rotation period is therefore not one eighth but is in reality three eighths of the amount at the center. The maximum stress-difference at the equator is, however, not in a vertical but is in the horizontal plane. There is doubt if tidal stresses could ever have been an effective agent in kneading liquid matter out of the earth's body, since the forces are relatively small and the *pressure gradient* due to that cause is very much smaller still. On the other hand, if the moon were much nearer the earth in primordial times the tidal stresses may have risen to an important magnitude.

But in closing we must not look at this or that detail, nor at this or that chapter. To gain a proper appreciation of the value of the investigations which are condensed in this volume we must compare the present state of thought upon the general subject with that of twenty years ago, before Chamberlin had begun to publish upon the hypotheses of earth genesis. Measured by that perspective this volume is seen to represent an advance in thought on this subject so great that the names of Chamberlin and Moulton must rank high among those scientists who have dealt constructively with that vast, vague and remote problem—the Origin of the Earth. The subject of earth genesis is now fairly on the road to scientific investigation in place of philosophic speculation. Joseph Barrell

PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES

The seventh number of volume 2 of the *Proceedings of the National Academy of Sciences* contains the following articles:

1. *On the Mobilities of Gas Ions in High Electric Fields:* Leonard B. Loeb, Ryerson Physical Laboratory, University of Chicago.

   The results, though at variance with those of most observers at low pressures for negative ions, are in good agreement with recent results of Wellisch, and likewise lead to the conclusion that the "cluster" theory is no longer tenable.

2. *The Relation of Myelin to the Loss of Water in the Mammalian Nervous System with Advancing Age:* Henry H. Donaldson, Wistar Institute of Anatomy and Biology, Philadelphia.

   There is no evidence that the cell bodies and their unsheathed axons suffer any significant loss of water; the progressive diminution in the water content of the brain and spinal cord is mainly due to the accumulation of myelin, the formation of which is a function of age, the most active production occurring during the first twentieth of the life span.

3. *Differential Mitoses in the Germ-Cell Cycle of Dineutes nigrior:* R. W. Hegner and C. P. Russell, Zoological Laboratory, University of Michigan.

   The most conspicuous difference that we have discovered between the origin of the oocyte in *Dineutes nigrior* and in *Dytiscus* is in the number of differential mitoses; in *Dineutes nigrior* there are only three whereas in *Dytiscus* there are four.

4. *Some Minerals from the Fluorite-Barite Vein near Wagon Wheel Gap, Colorado:* Esper S. Larson and Roger C. Wells, U. S. Geological Survey, Washington, D. C.

   A description of specimens of the unusual mineral gearksutite of a peculiar kaolinite and of a new fluoride-sulphate, creedite.

5. *The Processes taking Place in the Body by which the Number of Erythrocytes per Unit Volume of Blood is increased in acute Experimental Polycythæmia:* PAUL D. LAMSON, Pharmacological Laboratory, Johns Hopkins University.

It is concluded that the liver acts as a reservoir for erythrocytes. The process by which the liver increases the number of the erythrocytes is thought to be a loss of plasma from the liver capillaries together with a constriction of these vessels driving the erythrocytes on into the blood stream.

6. *The Influence of Morphin upon the Elimination of Intravenously Injected Dextrose in Dogs:* I. S. KLEINER AND S. J. MELTZER, Department of Physiology and Pharmacology, Rockefeller Institute for Medical Research.

Morphin increases the elimination through the kidneys of intravenously injected dextrose and retards the return of the sugar content of the blood to its previous level.

7. *The Work of the American Meteor Society in 1914 and 1915:* CHARLES P. OLIVIER, Leander McCormick Observatory, University of Virginia.

From the 5,543 observation of meters, 139 radiants have been deduced with sufficient accuracy to calculate parabolic orbits for the meteor streams they represent.

8. *The Light Excitation by Slow Positive and Neutral Particles:* A. J. DEMPSTER, Ryerson Physical Laboratory, University of Chicago.

Very slow positive rates are still able to excite light with a speed corresponding to less than 5 volts. The neutral rays can also excite light at very slow speeds; the excitation may occur directly because of the collision of a neutral particle with a neutral molecule of the gas.

9. *An Apparent Dependence of the Apex and Velocity of Solar Motion, as determined from Radial Velocities, upon Proper Motion:* C. D. PERRINE, Observatorio Nacional, Argentino, Córdoba.

The position of the solar apex and the solar velocity appear to vary with the proper motion of the stars used in the determination. Such variations point ultimately to some form of rotary or spiral motion among the stars.

10. *Channeled Grating Spectra, obtained in Successive Diffractions:* C. BARUS, Department of Physics, Brown University.

A brief abstract of work presented by the author to the Carnegie Institution of Washington.

11. *The Effect of Parental Alcoholism (and Certain other Drug Intoxications) upon the Progeny in the Domestic Fowl:* RAYMOND PEARL, Biological Laboratory, Maine Agricultural Experiment Station.

Out of 12 different characters for which we have exact quantitative data, the offspring of treated parents taken as a group are superior to offspring of untreated parents in 8 characters. The results with poultry are in *apparent* contradiction to the results of Stockard and others with mammals, but the contradiction is probably only apparent.

12. *The Effectors of Sea-Anemones:* G. H. PARKER, Zoological Laboratory of the Museum of Comparative Zoology at Harvard College.

It seems clear that among the muscles in sea-anemones there are not only independent effectors, and tonus muscles associated with nerve-nets, but neuromuscular combinations that exhibit true reflex action.

13. *Preliminary Evidence of Internal Motion in the Spiral Nebula Messier 101:* A. VAN MAANEN, Mount Wilson Solar Observatory, Carnegie Institution of Washington.

The mean rotational motion is 0.022″ left-handed; the mean radial motion is 0.007″ outward. There is perhaps a small decrease of the rotational motion with increasing distance from the center. The annual rotational component of 0.022″ at the mean distance from the center of 5′ corresponds to a rotational period of 85,000 years.

14. *Symposium on the Exploration of the Pacific—*

(*a*) *The Exploration of the Pacific:* W. M. DAVIS, Department of Geology and Geography, Harvard University.

(*b*) *The Importance of Gravity Observations at Sea on the Pacific:* John F. Hayford, College of Engineering, Northwestern University.

(*c*) *A New Method of Measuring the Acceleration of Gravity at Sea:* Lyman J. Briggs, Bureau of Plant Industry, Washington, D. C.

(*d*) *The Problem of Continental Fracturing and Diastrophism in Oceanica:* Charles Schuchert, Department of Geology, Yale University.

(*e*) *The Petrology of Some South Pacific Islands and its Significance:* Joseph P. Iddings, Brinklow, Maryland.

(*f*) *In Relation to the Extent of Knowledge Concerning the Oceanography of the Pacific:* G. W. Littlehales, U. S. Hydrographic Office, Washington, D. C.

(*g*) *Marine Meteorology and the General Circulation of the Atmosphere:* Charles F. Marvin, U. S. Weather Bureau, Washington, D. C.

(*h*) *On the Distribution of Pacific Invertebrates:* Wm. H. Dall, Smithsonian Institution, Washington, D. C.

(*i*) *The Marine Algae of the Pacific:* W. G. Farlow, Department of Botany, Harvard University.

(*j*) *The Pacific as a Field for Ethnological and Archæological Investigation:* J. Walter Fewkes, Bureau of American Ethnology, Washington, D. C.

(*k*) *Mid-Pacific Land Snail Faunas:* H. A. Pilsbry, Academy of Natural Sciences of Philadelphia.

(*l*) *Some Problems of the Pacific Floras:* Douglas H. Campbell, Department of Botany, Leland Stanford University.

The symposium contains a summary of some of the results obtained in past exploration of the Pacific and an outline of the importance to many sciences of further systematic and continuous exploration of the Pacific.

15. *Nervous Transmission in Sea-Anemones:* G. H. Parker, Zoological Laboratory of the Museum of Comparative Zoology at Harvard College.

There is evidence not only for the assumption of independent receptors, but of relatively independent transmission tracts. A first step in the kind of differentiation so characteristic of the nervous organization in the higher animals.

16. *The Responses of the Tentacles of Sea-Anemones:* G. H. Parker, Zoological Laboratory of the Museum of Comparative Zoology at Harvard College.

The tentacles, in contradistinction to such appendages as those of the arthropods and vertebrates, contain within themselves a complete neuromuscular mechanism by which their responses can be carried out independently of the rest of the animal.

Edwin Bidwell Wilson
Mass. Institute of Technology

SPECIAL ARTICLES

SOIL BACTERIA AND PHOSPHATES

Raw rock phosphate is by far the cheapest source of phosphorus to apply to soils. It consists chiefly of tricalcium phosphate, $Ca_3(PO_4)_2$, which is the most common form of phosphorus in the great natural deposits. This phosphorus compound is relatively insoluble in water, and, for this reason, it has been argued by some that it does not become available to plants; but long-continued field experiments, pot-culture experiments, and farm practise have fully demonstrated that this kind of phosphate does become available for plant growth.[1]

The increased beneficial results obtained by following the practise commonly recommended of intimately mixing decaying organic matter with the phosphate lead to the suggestion that the action of the soil bacteria that decompose organic matter might be an important factor in the solution of the phosphate.

It has been the common teaching that nitrifying bacteria require the presence of a free base, such as lime or an alkaline carbonate, but we have found that the bacterial action produces acid phosphate and proceeds in the presence of this acid salt.

The importance of the action of decomposition products of the active organic matter of

[1] See Circulars 181 and 186, Illinois Agricultural Experiment Station.