fishes to that of the first air-breathing animals which can range far from the water for long periods of time, and to the further stages attained in mammals has involved far more than the mere development of lungs. A new motor mechanism, with a highly organized and extremely efficient mechanism of nervous control, has been quite as necessary as the lungs themselves. The muscular changes have been considerable, but the changes in the nervous system have been quite as profound as those in the motor mechanism. But this nervous mechanism, in common with other highly organized machinery, has little possibility of new attainments (Hughlings Jackson) or of learning very much. Truly, the difficulties encountered in the transition from an aquatic to a terrestrial habitat have been great, and the first group to leave the water—the amphibians—has not wholly succeeded in overcoming them.[3]

The new mechanism, as far as I can see at present, first begins to assume a settled and definite form in reptiles. It is my present view, although the experimental evidence is not yet complete, that the respiratory connections with the midbrain, while partly established in amphibians, are first adequately established in reptiles. This seems only one more fact pointing to the importance of the reptilian group for the comparative physiologist who wishes to approach the study of the problems of organic evolution from the point of view of experimental physiology.

F. H. PIKE

COLUMBIA UNIVERSITY

A NEW FORMULA FOR THE ELECTRICAL RESISTANCE OF CERTAIN INHOMOGENEOUS SYSTEMS

IN the February number of the *Journal of Infectious Diseases* there is a paper by Dr. R. G. Green and myself dealing with the electrical conductance of systems of the following type: a suspension of yeast cells in a salt solution. In that paper we gave an approximate expression for the resistance of the suspension in terms of the volume occupied by the suspended particles and the specific resistances of the menstruum and of the suspended materials. I have recently arrived at a relation which I believe to be much more accurate.

Let c be the constant of the cell in which the resistances are measured; s, the specific resistance of the suspended material; a, the fraction of the total volume occupied by the suspended cells (assumed to be spherical); R, the resistance of the suspension; and M, the resistance when the salt solution alone fills the apparatus. Let $S = cs$.

Then the new equation is

$$R = M\left[\frac{1 + a\left(\frac{S-M}{2S+M}\right)}{1 - 2a\left(\frac{S-M}{2S+M}\right)}\right] \text{ or}$$

$$a = \frac{(R-M)(2S+M)}{(2R+M)(S-M)}$$

For the case in which the suspended particles have an infinite resistivity,

$$R = M\left(\frac{1+\frac{a}{2}}{1-a}\right) \quad \text{and} \quad a = \frac{2(R-M)}{2R+M}$$

Dr. Green and I will submit for publication in the near future a paper in which we shall undertake to prove the correctness of the formulae given above, and in which we shall apply them to experimental data old and new.

F. H. MACDOUGALL

SCHOOL OF CHEMISTRY,
UNIVERSITY OF MINNESOTA

[3] I am indebted to Dr. G. K. Noble for much information on the various adaptations and shifts which these forms have tried in the first attempt at terrestrial life. I would appreciate data bearing on peculiar means of respiration in other forms.

THE AMERICAN PHILOSOPHICAL SOCIETY

THE American Philosophical Society held its annual meeting in Philadelphia on April 24, 25 and 26, with the following program:

THURSDAY, APRIL 25

The fate of the soul of the elect in Manichaeism: A. V. WILLIAMS JACKSON, professor of Indo-Iranian Languages, Columbia University.

The Bornholm dialect of Danish: JOHN DYNELEY PRINCE, envoy extraordinary and minister plenipotentiary to Denmark.

Balder and the Golden Age: HERMANN COLLITZ, professor of Germanic philology, Johns Hopkins University.

Some effects of baths on man: H. C. BAZETT, B.Ch. (Oxon.), professor of physiology, University of Pennsylvania.

Differential permeability and cell reaction: M. H. JACOBS, Ph.D., professor of general physiology, University of Pennsylvania.

Pneumonia in Pittsburgh: EWALD TOMANEK, M.D., and EDWIN B. WILSON, Harvard School of Public Health.

The amending provision of the Federal Constitution in practice: HERMAN V. AMES, professor of history, University of Pennsylvania.

On the authorship of the anonymous pamphlet published in London, in 1760, entitled "The interest of Great Britain considered with regard to her colonies": I. MINIS HAYS, of Philadelphia.

The nation's transportation problem: EMORY R. JOHNSON, professor of transportation, University of Pennsylvania.