one decade which are discarded in the next; nevertheless, there is no body of individuals more competent than they to decide what doctrines are right, and if mistakes have been made, as they are bound to be with the best of intentions, the teachers and investigators have proven themselves to be the first to discover and to rectify the errors without the assistance of uninformed outsiders. We are never absolutely certain as to what constitutes truth, but if there is any method of insuring that what is taught is true better than that of giving investigators and teachers the utmost freedom to discover and proclaim the truth as they see it, that method has never been discovered. If those who know most about a subject sometimes decide wrongly, matters are not likely to be mended by putting the decision into the hands of those who know less.

Some of the proposed laws in regard to the teaching of evolution would forbid this doctrine to be taught as fact, while permitting it to be presented as theory. If such laws are justified at all, they should apply to all theoretical questions instead of singling out the theory of evolution for special attack. A teacher in any field is under a moral obligation not to teach as a fact a doctrine which is not yet established. But who is to decide what can reasonably be held as settled fact, and what is still in the realm of uncertainty? Most well-established generalizations begin as theories before they are finally accepted as truisms. This was true of the theory of the rotundity of the earth, although a minority might protest even now against teaching dogmatically that this theory is proven. The line between fact and theory would be drawn differently by different teachers. The attempt to settle such questions by law instead of allowing them to settle themselves in the light of advancing knowledge would create only endless mischief and confusion. The theory of evolution is one of those generalizations which are so far along on the high road to general acceptance as an established truth that teachers of biology differ as to whether, for practical purposes, it should be classed as fact or theory. So long as students as well as teachers are aware that there is a small measure of uncertainty attaching to most things regarded as facts, the distinction between what is called fact and what is an extremely probable theory is not one which urgently needs to be recognized by legislative enactment, especially since there is no way in which such questions can really be settled except through the advancement of knowledge.

The attempts which have been made to suppress all teaching of evolutionary theory, even as theory, are a menace not only to freedom, but to liberal education. Whatever one may think of the doctrine of evolution, he can not fail to recognize the fact that it has profoundly influenced thought not only in the biological sciences, but in psychology, sociology, education, ethics, political science, philosophy and many other fields of human knowledge. It is a doctrine, therefore, with which every person with any pretense to a liberal education should be familiar. Efforts to keep students from knowing about it are not only futile, but they constitute a violation of the rights of students to know what is the consensus of the best opinion on a great problem. Students have a right to know the pros and cons of controverted subjects in every field. Teachers should be free to present those subjects and to express their own position in regard to them. It is only the things that are not true which have anything to fear from freedom of discussion, and it is only by the maintenance of this freedom that we create conditions under which the truth will most rapidly prevail.

JOSEPH ALLEN,
J. H. BREASTED,
G. A. COE,
E. G. CONKLIN,
JOHN DEWEY,
R. F. GRIGGS,
VERNON KELLOGG,
SHAILER MATHEWS,
R. A. MILLIKAN,
E. C. MOORE,
HERBERT OSBORN,
W. PATTEN,
A. H. TURNER,
H. E. WALTER,
W. H. WELCH,
S. J. HOLMES, *chairman*

THE SECOND ANNUAL AMERICAN ASSOCIATION PRIZE

THE second annual prize of one thousand dollars has been divided this year into two equal prizes and these have been awarded (as already announced in SCIENCE for February 13) to Dr. L. R. Cleveland, of the School of Hygiene and Public Health of the Johns Hopkins University, and to Dr. Edwin P. Hubble, of the Mt. Wilson Observatory of the Carnegie Institution of Washington. It will be recalled that these annual prizes have been made possible through the public-spirited action of a member of the American Association whose name is to be withheld. The amount available is one thousand dollars each year and the awards are to be made for noteworthy contributions to science presented at the annual meetings of the American Association and associated societies. Four more years after the present are thus far provided for. The awards now announced are for papers presented at the recent Washington meeting.

Dr. Cleveland holds a National Research Council fellowship in biology and is engaged in research in medical zoology at the School of Hygiene and Public Health of the Johns Hopkins University, Baltimore. He received his bachelor's degree at the University of Mississippi in 1917 and the degree of doctor of science at Johns Hopkins University in 1923. He was instructor in biology in the University of Mississippi, 1916–18; in Emory University, 1918–20; instructor in zoology in Kansas State Agricultural College, 1920–21, and research fellow at Johns Hopkins University, 1921–23.

Dr. Cleveland presented two papers at the Washington meeting, in the program of the American Society of Zoologists, with the following titles: "The ability of termites to live perhaps indefinitely on a diet of pure cellulose," and "The effects of starvation and oxygenation on the symbiosis between termites and their intestinal protozoa, together with the toxicity of oxygen for free-living and parasitic protozoa." The following is a summary of the research work represented by the papers that won the prize, these notes having been kindly furnished to the permanent secretary's office by Dr. Cleveland.

Approximately 1,200 species of termites, or white ants, are known, most of which feed on wood. All that harbor protozoa are wood feeders. Some of these have been fed only pure cellulose for two years, with no signs of disturbance in nutrition or reproduction. These termites may without injury be freed from protozoa by 24-hour incubation at 36° C. or by confinement in oxygen at a pressure of 3.5 atmospheres for 40 minutes. Oxygen at several other pressures acts in the same manner. Mechanical gas pressure does not offer an explanation and the results are apparently to be related to a differential toxicity of oxygen. Starvation treatment kills all individuals of some genera of protozoa long before their termite hosts succumb. It has been possible to work out the relation of each protozoon to its host and to its fellow-protozoa. Probably all protozoa-harboring termites are dependent on the protozoa to digest their food for them. In the large Pacific Coast termite, *Termopsis,* either of the protozoa *Trichonympha* or *Leidyopsis* is able to keep its host alive indefinitely; *Trichomonas* is of some value as a symbiont; *Streblomastix* is of no value. When the essential protozoa are removed, the termites do not live more than three to four weeks on their normal diet of wood, although they live indefinitely on humus or on fungus-digested cellulose. If reinfected with protozoa, they become again able to live indefinitely on a wood diet.

The toxicity of oxygen for many parasitic and free-living protozoa has been determined. At a pressure of 3.5 atmospheres it is 50 times as toxic for the protozoa of termites as for the termites themselves. Cockroaches harbor many kinds of protozoa, all of which are killed by oxygenation at 3.5 atmospheres for 3.5 hours; the flagellates *Lophomonas* and *Polymastix* were killed in 40 minutes and the ciliates *Nyctotherus* and *Balantidium* in 3.5 hours; while the cockroaches themselves were not killed until the treatment had lasted 90 hours. Oxygen at this pressure is therefore 136 times as toxic for the flagellates and 26 times as toxic for the ciliates living in cockroaches as for the insects themselves. Earthworms when oxygenated lose their ciliates. Frogs harbor many protozoa. Oxygenation at 3.5 atmospheres of pressure kills *Hexamitus* in 5, *Polymastix* in 7, *Trichomonas* in 12, *Opalina* in 18, *Nyctotherus* in 28, and the frog in 65 hours. Oxygenation may probably remove the protozoa from all invertebrates and cold-blooded vertebrates without injury to the hosts. *Trichomonas* from frog, rat and man was oxygenated in culture and killed, but it has been found impossible to remove this organism from rats and man by oxygenation at a pressure of 3.5 atmospheres. The toxicity of oxygen for many free-living protozoa also has been determined. Oxygen is certainly just as toxic for some free-living ciliates as it is for parasitic ciliates; for others it is not. For *Paramoecium* and *Chilodion,* it is more toxic than for the parasitic forms: for *Diophrys* and *Holostica,* it is considerably less toxic.

Dr. Hubble holds the position of astronomer at the Mt. Wilson Observatory, Pasadena. He received his bachelor's degree at the University of Chicago in 1910, and his Ph.D. at the same university in 1917. He holds the degree M.A. from Oxford. Before appointment to his present position he was assistant in the Yerkes Observatory.

The paper for which the prize was awarded was presented in the joint program of the Mathematics, Physics and Astronomy sections of the Association, the title being "Cepheids in spiral nebulae." The researches thus represented are outlined below from notes kindly supplied by Dr. Hubble.

There are two sorts of nebulae. Galactic nebulae belong to our own stellar system, clouds of dust and gas excited to luminosity by some sort of radiation from involved or neighboring stars. Non-galactic nebulae, including the spirals, are outside of our stellar system and no definite data have hitherto been available concerning the fundamental problem of their distance, nor have promising methods been formulated heretofore for investigating their composition, structure and forces. It is with these non-galactic nebulae that these studies have dealt.

The significant feature of the present investigation is the partial resolution of the largest and brightest spirals into swarms of actual stars. This was accomplished by the use of the largest telescope in existence, being quite beyond the capacity of smaller instruments. As a first example of the methods and results of Dr. Hubble's work, Cepheid variables, almost always present in the great isolated systems of stars, have been found and employed as a criterion of distance. The paper presented at the Washington meeting gave a hasty summary of the results of this particular phase. The results are checked by a study of novae, distribution of stellar colors and of stellar luminosities in the spirals. There is little

doubt that the general principle of the uniformity of nature applies here and that the stars of non-galactic nebulae are the same sort of bodies with which we are familiar in our local system. But the most important feature is in the background of the paper, the uncovering of targets for the heavy artillery of methods for stellar investigation.

The author's abstract of the paper presented at the meeting is as follows: "On photographs made with the 100-inch and 60-inch reflectors of the Mount Wilson Observatory, the outer regions of the two spirals M 31 and M 33 are resolved into dense swarms of actual stars. Many of these stars are variable and of the variables a large percentage are Cepheids. Normal curves, periods and photographic magnitudes have been determined for 22 Cepheids in M 33 and 12 in M 31. The magnitudes at maximum run from 18.1 to 19.1 and the periods from 18 to 50 days. The period-luminosity relation is conspicuously present. The distances, as derived from Shapley's period-luminosity curve, are the same for both nebulae—about 285,000 parsecs. Variables have also been found in M 81, M 101 and N. G. C. 2403, but nothing is known as yet of their periods."—B. E. L.

SCIENTIFIC EVENTS

INTERNATIONAL ANNUAL TABLES

DR. CHARLES MARIE, general secretary of the International Commission charged with the compilation and publication of "International Annual Tables of Constants and Numerical Data, Physical, Chemical and Technological," announces the publication of Volume 5, Part 1. This volume gives all numerical data which characterize any substance, material or system which are to be found in the world's literature for the period of 1917–1922, inclusive, and covers the sciences of physics, chemistry, mineralogy, biology and the various branches of technology. Owing to the large volume of modern scientific literature, these volumes will be of great value to scientific men having occasion to use numerical data. The volumes give not only the data as they appear in the original literature, but also the corresponding literature reference for every value recorded.

This international undertaking is carried on without profit and is made possible by the financial support of governments, scientific societies and educational institutions which contribute to the international fund. Members of scientific organizations and of the faculties of universities which help in this way to make possible the compilation of annual tables are accorded a special discount on purchases of these volumes. The volumes are distributed in the United States through the University of Chicago Press. The following is a list of American contributors to the international fund:

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E. W. WASHBURN,
American Commissioner

THE THIRD ASIATIC EXPEDITION OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE members of the Third Asiatic Expedition of the American Museum of Natural History, New York, sailed from San Francisco on the *President Lincoln* on March 7 for China. This is the largest scientific expedition ever sent out by the museum. The party sails to meet Roy Chapman Andrews, leader of the Third Asiatic Expedition, to commence its third year's work in China and Mongolia. The personnel of the party is as follows:

Walter Granger, paleontologist and second in command.

Dr. Charles P. Berkey, geologist, professor of geology at Columbia University.

Frederick Morris, assistant geologist, previously of Columbia University and Peyang University in Tientsin.

Major L. B. Roberts, topographer, member of United States aerial mapping force in France during the war. Resident of Kansas City.

Dr. Ralph W. Chaney, botanist and paleobotanist of Carnegie Institution of Washington.