the distribution of blood and the evaporation of water which constitute the "physical regulation of body temperature." Although Cannon has quoted generously from recent contemporaneous literature, the critic may perhaps be pardoned for asking why, of the older authorities, Claude Bernard alone should be the scientist freely cited. Perhaps, however, the charm of the book lies in the fact that it represents enticingly the view-point of a laboratory worker of rich experience speaking out of that fulness of personal knowledge, a method which compels interest in the subject and regard for the author.

In a final chapter Cannon discusses the possibility of the establishment of a "steady state" in the social and economic world. In this he follows the example of Aristotle in a celebrated passage which began, "The animal organism is to be conceived after the similitude of a well-governed commonwealth." Cannon suggests that the steady state of the fluid matrix of the animal organism indicates that the social organism should be provided with specially organized control over the processes of commerce. This would include the power to limit the production of goods so as to adjust the supply reasonably to the demand, the power to lay aside stores of goods and stores of wages and the power to arrange emergency employment. All these in a measure are represented as factors of safety in the human body. Perhaps one might suggest another analogy, which is, the fact that a human being, through undernutrition, may be brought to a level of maintenance of two thirds the quantity of food necessary for the normally nourished, even though at some loss of the sense of personal well-being. At a time when wheat is selling at the farm at 25 cents a bushel, in contrast with $2.20 during the war, it does not seem right that war-time wages should be practically guaranteed to railroad workers. Perhaps in times of economic distress the political leaders of Aristotle's "well-governed commonwealth" would have been so wise and so free from vote-getting ambition as to have decreed a reduction in railroad wages suggested by the 30 per cent. physiologically possible reduction in food calories, to the end that other wage-earners might be continuously employed. Into such seemingly fantastic analogies contemplation of the "Wisdom of the Body" leads us.

GRAHAM LUSK

The Universe Unfolding, By ROBERT H. BAKER, x + 140 pages. The Williams and Wilkins Company, Baltimore, 1932. $1.00.

THIS is an excellent book to be one of the volumes of the Century of Progress Series. The originality shown in the manner of presenting the astronomical facts will appeal alike to those who already know these facts, and to those who do not. It is a long way from the flat circular plane of the Greek's earth, over which bends the solid stationary dome of the sky, to the universe of galaxies and supergalaxies lying millions of light years beyond the solar system. However, the 140 pages of the book do cover this distance in a very satisfactory manner, and among these pages will be found the answers to many questions frequently asked by people in general about the modern methods of investigating the astronomical universe. This book can hardly fail to give any reader a better understanding and a greater interest in "the vast universe around us and the mysterious mind of man."

The first chapter tells of the universe as man in the past understood it, first according to the Ptolemaic system with the stationary earth at the center, and then according to the system of Copernicus with a central sun about which the earth and the other planets revolve. The second chapter takes up the story of the investigation of the sidereal system from the star gauges of Herschel to the statistical studies of Kapteyn, and then on to the work of the present day which has disclosed millions of vast stellar systems. The remaining chapters are devoted to the modern methods of investigating the structure of the universe. These describe the various methods of attack on this problem and tell the amount of success achieved by each method. The last chapter brings this interesting account up to the most recent discovery, which is that the exterior galaxies appear to have huge velocities of recession with respect to our own galactic system.

IDA BARNEY

YALE UNIVERSITY OBSERVATORY

SOCIETIES AND ACADEMIES

THE IOWA ACADEMY OF SCIENCE

THE forty-sixth annual meeting of the Iowa Academy of Science was held with Iowa State Teachers College at Cedar Falls on April 29 and 30, 1932, with 245 members and visitors in registered attendance.

The presidential address, "Our Underground Geology," was presented by Dr. James H. Lees, of the Iowa Geological Survey. Other papers of general interest were: "The Oxidation of Citric Acid," by Adrian S. Kuyper, of Iowa State University; "Some Observations on Spectral Color Discrimination," by Le Roy D. Weld, of Coe College; "The Effect of Preschool Attendance upon Intelligence Quotient," by Dr. Beth L. Wellman, of the Iowa Child Welfare Research Station; "The Iowa Conservation Plan," by

J. R. Crane, of the Iowa Fish and Game Commission. The annual academy lecture was presented by Dr. L. L. Thurstone, of the University of Chicago, on "The Measurements of Social Attitudes."

The Junior Academy of Science of Iowa met with the Iowa Academy at this time for its organization meeting. The following officers were elected: *President,* Henry Estabrooks, Dubuque High School; *vice-president,* Dwight Thompson, Des Moines; *secretary,* Genevieve Ostergaard, of Cedar Falls; and *treasurer,* Walter Brown, of Cedar Falls.

The officers of the academy and the chairmen of its sections for the forthcoming year will be: *President,* H. E. Jaques, Iowa Wesleyan College; *vice-president,* J. E. Guthrie, Iowa State College; *treasurer,* W. F. Loehwing, Iowa State University; *secretary and American Association for the Advancement of Science representative,* Joseph C. Gilman, Iowa State College; *editor,* Mrs. F. W. Nichols, Ames; *bacteriology and botany,* C. H. Werkman, Iowa State College; *chemistry, general and physical,* W. B. Zuker, Dubuque; *chemistry, organic and biological,* L. W. Sherman, Grinnell College; *geology,* J. E. Smith, Iowa State College; *mathematics,* L. M. Coffin, Coe College; *physics,* H. J. Plagge, Iowa State College; *psychology,* L. C. Douglass, Grinnell College; and *zoology,* E. R. Becker, Iowa State College.

The Academy convened in eight sections for the presentation of 133 papers of special interest. The retiring section chairmen made the following reports of their respective meetings.

Bacteriology and Botany: G. W. MARTIN, *chairman.* Of the thirty-one papers in the bacteriology-botany section eleven were concerned with bacteria and fungi in various relations and the remainder with botanical studies ranging from papers on mosses and ferns to those in the fields of morphology, cytology and taxonomy. An important feature of the program was the conference on the teaching of botany held on Friday morning, which was largely attended At the close it was voted to continue this phase of the meeting another year.

Chemistry: H. GREGG SMITH, *Chairman.* Among the papers presented before the organic-biological section were the following: "Vanillin Substitution Products with Acetophenone," by Gundy and Raiford; "Condensation of Furan, and Furan Arsenicals," by Henry Gilman and his students; "Reaction of Chloroamines with Zinc Alkyls," by Coleman and Andersen; and two papers on "Phenolic Ketimines," by Culbertson and his students. The biological papers included: "A Statistical Analysis of the Growth of Rats in the Stock Colony of the Foods and Nutrition Department of Iowa State College during the Years 1928–31," by Gladys Timson, Pearl P. Swanson and P. Mabel Nelson; "Vegetable Lecithin as an Antioxidant," by Kochenderfer and H. G. Smith; "A Study of Methods for the Determination of Reducing Sugar in Bacteriological Media," by McCreary and H. G. Smith. Of special interest was a report on 'The Rôle of Copper in Hemoglobin Regeneration," by Keil and V. E. Nelson, in which the importance of traces of copper was emphasized. The joint dinner of all the chemists was addressed by Drs. Raiford, Knight, Bartow and Petersen.

Geology: E. J. CABLE, *Chairman.* The Geology Section of the Iowa Academy of Science which met at Cedar Falls, Iowa, on April 29 and 30, had a most interesting and profitable meeting. Papers representing stratigraphic, paleontologic and Pleistocene geology were ably presented and discussed. Some of the more outstanding papers were, "Interpretation of the Relationships of Iowan Drift," "The Peorian Loess," and "The Wisconsin Drift from Recent Studies in Iowa and Illinois"; "The Upper Devonian Beds in Iowa County," "Sedimentation of the Cedar Valley Limestone"; "The Cedar Valley Limestone at Gloria and Waterloo, Iowa"; "Interglacial Mammalian Remains"; The Story-Hamilton Artesian Area"; "Discussion of the Section of the United States from Lake Superior in Wisconsin to Oklahoma," prepared by the Kansas State Geological Society; "Ice Caves," and several other papers of less importance.

Physics: T. C. POULTER, *Chairman.* A group of twenty-one papers, covering a number of very interesting topics was presented and discussed in the Physics Section meeting of the Iowa Academy of Science. Several papers were presented in the Friday afternoon session followed by the Physics dinner at the Tip Top Tavern. Following the dinner a very interesting and inspiring lecture was given by Dr. C. J. Lapp, of the Department of Physics, University of Iowa, on "The Structure of the Nucleus." This lecture was well illustrated by lantern slides. A vast amount of recent information was presented on the most fascinating topic in modern physics. The remainder of the papers were presented at the Saturday morning session, following which Dr. H. G. Plagge, of Iowa State College, was elected chairman of the Physics Section for the coming year.

Psychology: THOMAS F. VANCE, *Chairman.* Among the eight sections of the Iowa Academy of Science, Psychology ranked third in the number of papers presented at the 1932 meeting. The eighteen papers may be classified as follows: General 3, educational 7, child 3, tests and measurements 4, and industrial 1. Space does not permit the listing of the papers pre-

sented but they will be published either in full or by abstract in the "Proceedings" of the academy. This year the academy's evening lecture was in the field of psychology, Dr. L. L. Thurstone being the speaker on the subject, "The Measurement of Social Attitudes." Dr. Thurstone also spoke to the psychologists assembled at dinner on the subject, "Modern Psychophysics."

JOSEPH C. GILMAN,
Secretary

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW HYDROGEN ELECTRODE AND APPARATUS FOR THE DETERMINATION OF pH

IT is known that, in order to measure the pH of liquids containing CO_2 in solution, such as blood, serum, tyrode solution, etc., it is necessary to prevent the escape of CO_2 which would result in an erroneous reading. Furthermore, Hasselbach and Clark have shown that it was necessary, in order to obtain reliable and stable measurements, to keep the platinized-platinum electrode successively in contact with the liquid and with the atmosphere of hydrogen. This is obtained, in the well known Clark's electrode, by shaking the vessel by means of an electric motor. This method can be considered as standard and yields excellent results. However, it requires rather large quantities of serum or blood (6 cc), and the time necessary to reach the equilibrium is long. Besides, the apparatus, entirely made of glass, incorporates four glass stopcocks, rubber tubing, clamp, and does not lend itself to an easy temperature control.

We have recently worked out an hydrogen electrode in which the equilibrium is reached in about one minute, for ordinary solutions, with less than one cc of liquid. The principle is different from that of Clark's electrode as it is based on the permanent rotation of a tilted electrode in the shape of a disk, one half of which dips in the liquid, the other half being in the hydrogen. During its rotation, a thin layer of liquid carried by the disk is constantly brought in contact with H_2 and, as the rate of rotation may be as high as 500 revolutions a minute, the saturation takes place in a very short time. The readings are taken while the electrode is in motion, and are very constant. It is useless to say that all sorts of shapes can be used for the platinum electrode: spiral, screw propeller, etc. Of course, a proper technique is used to fill the cup with the serum and introduce H_2 with the minimum possible loss of CO_2. (Fig. 1). Practically, a glass syringe is used: the platinum disk is fixed to the piston, and the liquid-liquid junction is established through a capillary tube. One or two hydrogen bubbles are sufficient.

In order to simplify the handling and to reduce the chances of breakage, we have the whole apparatus (hydrogen and calomel electrodes stand) made of metal (see Figs. 2 and 3), the only glass parts being

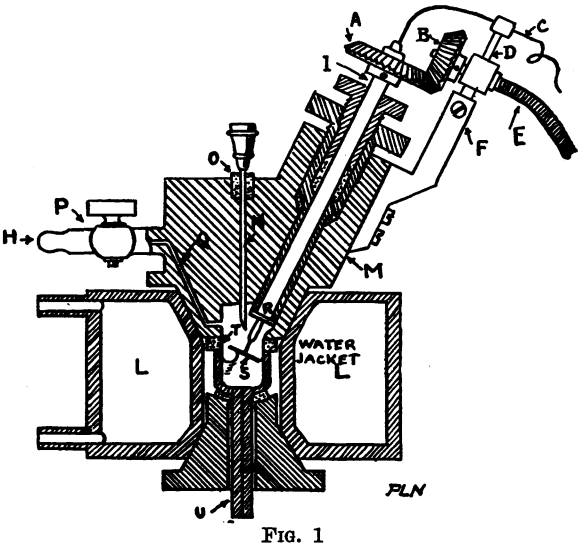

FIG. 1

the syringe and the calomel electrode. Both hydrogen and calomel electrodes are water-jacketed and may be taken apart in a few seconds. No glass stopcocks, nor expensive glass parts are used. No troublesome diffusion was observed in one hour.

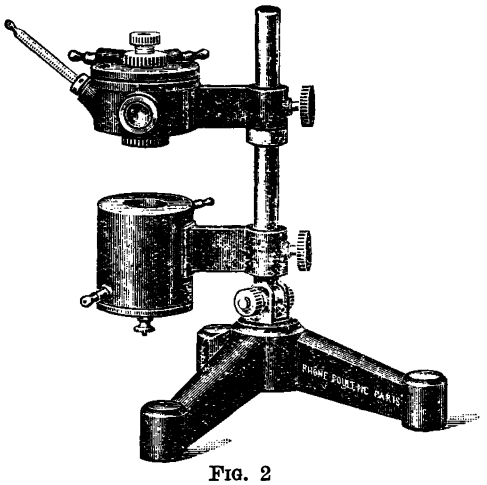

FIG. 2

When this instrument is used to determine the pH of ordinary solutions, the rotatory electrode is no longer absolutely necessary. It may then be replaced —and the change is done instantaneously—by a simple platinum tube, through which the hydrogen is allowed to bubble gently in the liquid. In this way,