College of Brown University was selected for study; its members were tested in 1923 with the Brown University Psychological Examination. The scores of several could not be used because no information on their reproductive histories was available; they were not significantly different in intelligence from the remainder of the group.

The total group was divided at the median into a high-scoring and a low-scoring group of 54 subjects each; 36 live births had been reported for the former and 37 for the latter. Further subdivisions were made to correct for inequalities among the dates of latest reproductivity information, but no significant differences appeared beween the groups. A comparison of marriage dates also revealed no significant differences.

While these data are obviously inadequate, the tentative conclusion may be drawn from them that test intelligence is not a factor in the reproductive histories of college women, at least so far as the most fertile years are concerned. It is also incidentally evident that college women, like college men, fall considerably short of reproducing themselves. It is to be hoped that these conclusions and those of the inquiry previously referred to may be repeatedly examined as more data become available on the reproductive histories of the early test populations.

RAYMOND R. WILLOUGHBY
BROWN UNIVERSITY

THE ROLE OF THIAMIN IN ORGANIC EVOLUTION

IN connection with the article of Dr. R. R. Williams (SCIENCE, June 24, 1938), it may be of interest to point out that the assumption that thiamin is needed by all living cells, together with the statement that "only the higher plants can make it," would completely disrupt the concept of the evolution of higher from lower forms of life.

HUGO P. KORTSCHAK
EXPERIMENT STATION OF THE
HAWAIIAN PLANTERS' ASSOCIATION

DR. KORTSCHAK'S inference that my conception of the role of thiamin in the living world is at variance with the idea of the evolution of higher from lower forms of life is not one which I intended the reader to draw. On the contrary, I believe that our knowledge of the rôle of thiamin in living things has contributed a most important bit of chemical evidence that all forms of life have a common heritage. The single sentence which Dr. Kortschak quotes is taken from a brief paragraph in which I attempted to condense for the sake of perspective the results of some scores of experimental studies by various workers. It accordingly is lacking in accuracy of detail. Some, at least scanty, powers of synthesis of thiamin are doubtless to be found among the lower plants.

It does appear, on the basis of present evidence, that the higher plants are responsible for synthesizing most of the thiamin in living nature. However, it is not at all clear to what extent lower plants have failed to develop ample synthetic powers in this respect and to what extent past powers may have been lost through symbiotic or saprophytic habits.

R. R. WILLIAMS
BELL TELEPHONE LABORATORIES

SOCIETIES AND MEETINGS

AMERICAN GEOPHYSICAL UNION

THE *Transactions* of the nineteenth annual general assembly of the American Geophysical Union and the meetings of its seven sections, held from April 27 to 30, 1938, at Washington, D. C., and of regional meetings at Spokane, Wash., December 28 and 29, 1937, and at Davis, Calif., January 7 and 8, 1938, are now in press. Part I of 585 pages relates to the Washington meetings, and Part II of some 160 pages relates to the regional meetings.

Because of the importance of the minutes of the general assembly and of those of the sections, with their appendices, in the general view of the development of the union and of their interest to all its members, they have been included, for the first time, as a part of the *Transactions*. The total attendance of members and guests—534 at Washington—marks the character of the meetings in 1938 and the growing import of the union as a factor in the progress of geophysics in the United States. The attendance at the regional meetings also emphasizes this progress.

Included in the minutes are the reports of officers and of standing, special and research committees. Especially noteworthy are those of the newly formed planning and project committee and of the two committees on geophysical and geological study of oceanic basins and on geophysical and geological study of continents. These show the many problems calling for intensive theoretical research and potential possibilities of their applications in profound problems of earth physics.

The respective presidents, vice-presidents and secretaries of the union and its sections for three-year terms, July 1, 1938, to June 30, 1941, except as otherwise noted, are:

Union: R. M. Field; W. C. Lowdermilk; J. A. Fleming (1937–1940).

Geodesy: C. H. Swick; R. M. Wilson; W. D. Sutcliffe (1937–1940).
Seismology: J. B. Macelwane; H. E. McComb; F. Neumann (1936–1939).
Meteorology: R. H. Weightman; C. W. Thornthwaite; H. D. Harradon.
Terrestrial Magnetism and Electricity: E. O. Hulburt; E. A. Eckhardt; J. Wallace Joyce.
Oceanography: C. E. Iselin; G. F. McEwen; P. C. Whitney.
Volcanology: E. G. Zies; Adolph Knopf; James Gilluly.
Hydrology: L. K. Sherman; J. E. Church; K. H. Beij (all 1936–1939).

Four of the six resolutions adopted at the general assembly relate to magnetic survey of the land- and water-areas of the United States, geophysical survey of the Central Atlantic States, location of meteorological stations and meteorological research-projects. The other two resolutions express thanks for privileges extended at the Washington meetings by the Smithsonian Institution and the U. S. Geological Survey.

Preparations are well advanced for the seventh triennial assembly of the International Union of Geodesy and Geophysics, to be held in September, 1939, at Washington, D. C. During the nineteenth annual meeting of the American Geophysical Union, one evening was devoted to a smoker to discuss these preparations and to formulate further plans. This will be the first assembly of the International Union in the United States since its formation in 1919. It will afford opportunity to reciprocate the courtesies shown us at the six assemblies in Europe and to inform our foreign colleagues of the extent of geophysical research and interests in the United States. It is hoped especially that all the nations of South and North America will avail themselves of the opportunity to take active part in the Washington assembly.

The scientific session of the general assembly in 1938 was devoted to a symposium on the physics of volcanic processes. Five formal papers presented were: "Introductory—Applying Physics to Volcanoes," by Arthur L. Day; "Surface-Manifestations of Volcanic Activity," by E. G. Zies; "Structural Development of Volcanic Cones," by T. A. Jaggar; "Rock-Structures Associated with Some Ancient Volcanoes," by Chas. B. Hunt; "The Roots of Volcanoes," by Reginald A. Daly. Following a summary of the symposium by L. H. Adams, there was an extended and searching discussion.

In the Section of Geodesy 15 papers and reports were presented at two sessions. Five of these dealt with progress and development of geodetic operations and instruments in Canada, Central America, Mexico and the United States; seven related to gravimetric surveys, apparatus, interpretations and relation of gravity-anomalies and geologic structure; one each related to improvement of time-service and broadcasting, to sea-level datum and to the mathematical treatment of accidental and other errors.

The Section of Seismology held one session. The 12 communications may be classified as follows: Theoretical interpretations and analysis, 4; individual earthquakes and seismic measurements, 2; seismic instruments, 3; microseisms, 1; geophysical investigations of geologic structure, 1; progress-report for the United States, 1.

The Section of Meteorology heard six papers at one session. These concerned ultra-violet solar radiation (2), velocity of sound-waves (1), compilation of observations (1), expeditions (1) and meteorological aspects of radio-transmission phenomena (1).

Sixteen communications were presented at the session of the Section of Terrestrial Magnetism and Electricity. These related to instruments and technique (3), ionosphere and magnetic correlations (2), cosmic radiation (2), solar relations (1), fossil magnetization as determined from ocean-bottom core-samples (2), secular variation (1), auroral-zone currents (1), possible seismic and magnetic relations (1) and terrestrial electricity (3). The secretary submitted brief summaries of progress-reports dealing with magnetic and electric researches received from five organizations on work in Peru, Western Australia and the United States, including Alaska, Hawaii and Puerto Rico.

Ten papers before the meeting of the Section of Oceanography concerned progress during the year of four governmental and private organizations doing oceanographic work in the United States. One paper each related to the Gulf Stream System, deep-sea measurements without cables, chemical oceanography, an international program for collecting samples of ocean-water and methods of representing suboceanic relief on maps. A report from the International Commission on Continental and Oceanic Structure gave important features relating to an international program arranged for cooperative gravimetric work at sea.

At two sessions of the Section of Volcanology 12 papers dealing with igneous rocks and effects of temperature and pressure were read and discussed.

One of the important features of the nineteenth annual meeting was a joint meeting of the Sections of Meteorology and Oceanography. The 13 papers presented at the two sessions of this joint meeting were devoted to a symposium on atmospheric and oceanic circulation.

There were four sessions of the Section of Hydrol-

ogy for the presentation of reports and papers. Twenty-four papers, with discussions, may be roughly grouped as follows: Rainfall, infiltration and groundwater, 15, and one appendix; stream-flow and flood-control, 6; and one each on evaporation, on glaciology and on contributions of the Water Resources Committee to hydrological investigations. The annual reports of permanent research committees were received and discussed as follows: (1) Snow; (2) glaciers; (3) evaporation from water-surfaces; (4) runoff; (5) physics of soil-moisture; (6) underground waters, with three appendices; (7) dynamics of streams; (8) chemistry of natural waters; (9) rainfall. Reports were also presented by newly formed special committees as follows: (1) Soil Conservation Service; (2) flood-waves, with six appendices; (3) density-currents. The total of 45 reports and papers affords evidence of the activity of the section.

The regional meetings of the Section of Hydrology at Spokane, Wash., and Davis, Calif., were arranged by special committees, of which W. A. Lamb and Morrough P. O'Brien were chairmen, respectively. Only three formal hydrological papers were presented before the North Continental Divide regional meeting at Spokane, the time being largely devoted to conferences and discussions; this meeting was held in affiliation with the Northwest Scientific Association.

The South Pacific Coast regional meeting at Davis, Calif., was held jointly with the Western Interstate Snow-Survey Conference. Sixteen formal hydrological papers were presented at three sessions, January 7 and 8, 1938. These related to hydrometeorology, precipitation and vegetation, evaporation, transpiration, forest and range hydrology (in relation to water-supply, forest management, live-stock industry and flood-control), floods, flood-control, evaporation and runoff from snow and studies in quality of irrigation-water. Nineteen reports and papers were presented and discussed at the Snow-Survey Conference on development of snow-surveying, methods of forecasting, economic aspects of snow-surveying, improvement of snow-survey equipment and winter sports. This meeting was concluded with a round-table conference and dinner.

The present *Transactions*, edited by the general secretary, include either in full or in abstract in Part I 140 papers and reports presented at Washington, and in Part II 38 papers and reports not elsewhere reported, with discussions presented during the regional meetings at Spokane and at Davis.

These *Transactions* afford further evidence of the scientific and economic value of geophysical research and of the contribution of the union through its coordination of many agencies. Further substantial progress may be confidently expected through the activities of the special committees of the union and of its sections, including the newly created planning and project committee.

JNO. A. FLEMING,
General Secretary

SPECIAL ARTICLES

THE SURVIVAL OF PLANT CELLS IMMERSED IN LIQUID AIR

A REVIEW of the literature[1] on the survival of plants or animals exposed to extremely low temperatures reveals that two kinds of organisms can support an immersion in liquid air (about −190° C.): (1) Those which resist a previous drying, *e.g.*, seeds, spores, protozoan cysts, tardigrades, nematodes; (2) those which do not exceed a few micra in size, *e.g.*, bacteria, yeast, monocellular algae, flagellates of the type trypanosome. This observation suggests that the survival might be due to the fact that water does not crystallize in these organisms, either because there is not enough water left in them to freeze, or because, on account of their small size and relatively large area, so much water can be withdrawn from them by osmosis during the congelation of their culture medium that they are practically desiccated. (The resistance to congelation offered by capillarity does not seem to be sufficient, alone, to explain the cold resistance of micro-organisms.) If, then, crystallization of water is the factor responsible for death by low temperature, all the cells in which formation of ice can be prevented should survive. In the research reported here, we intended to study if and to what extent protoplasm vitrified at low temperatures (as described in a previous work[2]) that is, protoplasm hard and breakable like glass, but in which water had not crystallized, keeps its vitality.

In the work just mentioned, it has been shown: (1) That gelatin gels containing 37 to 90 per cent. water can be brought into the vitreous state by a sudden immersion in liquid air; (2) that the thickness of the vitrifiable layer decreases with increasing water-content, extending from 0.3 mm to a few micra when the water content varies from 50 to 90 per cent.; (3) that the temperatures at which the material crystallizes cover a range of some 15 degrees only (from 0° to about −15° C.) and that crystallization takes place either during a cooling from the atmospheric to sub-

[1] B. J. Luyet and P. M. Gehenio, *Biodynamica*, No. 33, 1938.

[2] B. J. Luyet, *Biodynamica*, No. 29, 1937.