teriology and pathology in Georgetown University Medical School and pathologist to Georgetown University Hospital, Washington, D. C.

DR. GERALD L. WENDT has resigned his position with the Standard Oil Company to take the position of dean of the school of chemistry and physics at the Pennsylvania State College.

DR. L. W. DURRELL, formerly assistant plant pathologist at the Iowa Agricultural Experiment Station, has been appointed head of the department of botany of the Colorado State Agricultural College.

A. A. PACKARD, instructor in physics at Syracuse University, has been appointed assistant professor of physics and mathematics at St. Stephens College, Annandale-on-Hudson, N. Y.

DR. C. C. MACDUFFEE, assistant professor of mathematics at Princeton University, has accepted an assistant professorship of mathematics at the Ohio State University.

DR. DONALD A. LAIRD, National Research Fellow in Psychology, has been appointed associate professor of psychology at Colgate University.

DR. DAVID MURRAY LYON, assistant physician to the Royal Infirmary, Edinburgh, has been appointed Christison professor of therapeutics in the University of Edinburgh in succession to Dr. J. C. Meakins, who has become professor of medicine at McGill University.

PROFESSOR W. J. DE HAAS, of Groningen, has been appointed to succeed Professor H. Kamerlingh Onnes, of Leyden, who has resigned.

DISCUSSION AND CORRESPONDENCE

AMERICAN USES OF GLOBES BEFORE 1800

IN reviewing the beautiful and instructive work on "Celestial and Terrestrial Globes,"[1] by Stevenson, I ventured the assertion that undoubtedly American discussions of globes could be found in the period before 1800, to which Dr. Stevenson confines his discussion. Colonial references are fairly numerous and as it may stimulate some further explanation along this line in this interesting period of American history I list here a few of the references which have come to my attention.

In 1753 Theophilus Grew, a professor at the academy in Philadelphia which has become the University of Pennsylvania, published a treatise on globes. The title reads:

The Description and *Use* of the *Globes*, Celestial and Terrestrial; With Variety for *Examples* For the Learner's *Exercises*: Intended for the Use of such Persons as would attain to the Knowledge of those *Instruments; But* Chiefly designed for the *Instruction* of the young *Gentlemen* at the *Aca-demy* in Philadelphia. To which is added *Rules* for working all the Cases in Plain and Spherical Triangles without a Scheme. By *Theophilus Grew*, Mathematical Professor. Germantown, Printed by *Christopher Sower*, 1753 [pp. 60, (2)].

Copies of the work are found in the Pennsylvania Historical Society Library[2] and in the library of the University of Pennsylvania.

After 16 pages of description Grew takes up the common problems on the use of both globes (pp. 17–45). A treatise on plane and spherical trigonometry is probably the earliest published in the United States. This begins with right triangles (pp. 46–47); oblique angled plain triangles (pp. 48–50); right angled spherical triangles (pp. 50–55), and oblique angled spherical triangles (pp. 55–60).

This little printed work is evidence of the widespread interest in globes in the colonies. Washington had a terrestrial globe in his library, now in the Mount Vernon Museum. Unfortunately the globe is in need of repairs and the name of the make could not be deciphered by the Custodian of the Museum, who courteously gave me information concerning it. Benjamin Franklin ("Writings," ed. A. H. Smith: Vol. III, New York, 1905, pp. 89–91) in writing on June 20, 1752, to his London correspondent, William Strahan, ordered a pair of globes.

> Please send me another of Popple's Maps of North America . . .; a Pair of Mrs. Senex's improved Globes, . . . (or Neal's improv'd Globes, if thought better than Senex's) the best and largest that may be had for (not exceeding) Eight Guineas.

In the *Kentucky Gazette* of May 23, 1789, Jeremiah Moriarty advertises that he "will teach dancing. Teaches geography and use of the globes, having a pair on a new construction with Captain Cook's discoveries."

In New England one would expect a lively interest in the subject; works on surveying, navigation and travel were in great demand. An able mathematician, Nathan Prince, of Harvard, advertised in the Boston *Evening Post* of Monday, April 4, 1743, that he proposes "on suitable Encouragement, to open a School . . . for the instructing of young Gentlemen in . . . Mathematicks . . . Geometry . . . Algebra . . . in Trigonometry and Navigation; in Geography and Astronomy, With the Use of the Globes, and the several kinds of Projecting the Sphere. . . .

[1] SCIENCE, Vol. 56, pp. 199–201, August 18, 1922.

[2] The writer is indebted to the librarian, Dr. Montgomery, for loaning this copy to the William L. Clements Library for his use.

American geographies like that of Payne (New York, 1798) commonly included sections on the globes. Payne discusses (Vol. I, pp. xxxiii–xxxviii) "Problems performed by the globe; Jedidiah Morse (American Geography, 3d ed'n, Boston, 1796) gives a ten-page discussion, with problems, on both Terrestrial and Celestial globes, and the same space is devoted to this topic in the first American edition (Philadelphia, 1794) of Guthries's Geography. It is worthy of note that David Rittenhouse contributed to the astronomical portion of the American edition.

The first astronomical book printed in America was the "Phisica, Speculatio . . . Accessit compendium sphere Campani," by Alonzo de Vera Cruz (Mexico, 1557). An examination of this work and later Mexican works in astronomy and geography would be likely to reveal some use of globes in Spanish America.

These notes are intended to indicate some of the various sources of information concerning early American uses of the globes and also their intimate connection with early astronomy and mathematics in the New World.

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ON THE EXCRETORY APPARATUS IN PARAMECIUM

CERTAIN observations[1] on the morphology of the contractile vacuole and feeding canals in *Paramecium caudatum* warrant the following conclusions:

The pore, contractile vacuole and canals (eight to eleven in number) form a continuous, permanent ectoplasmic *structure*. There is here, therefore, neither evidence of nor necessity for a sol-gel reversibility of the cytoplasm, as set forth by Taylor ('23) to explain the mechanism of the contractile vacuole in *Euplotes*.

In a longitudinal section through the cortex, at right angles to a perpendicular line drawn through the pore to the bottom of the vacuole, the pore is seen on the surface as a clear, circular opening continuous with the vacuole below, showing no intervening membrane. Longitudinal and cross sections through the axis of pore and vacuole also show that the pore and vacuole are continuous. The vacuole can be distinguished in all stages of systole and diastole so far observed. During the stage of maximum contraction it is a minute central space with delicate radiating tubes, each of which leads to the bulbous end of a feeding canal. As the canals give up their contents to the vacuole, the vacuole gradually increases in size; meanwhile, the bore of the canals diminishes. The distention of the vacuole in stages of diastole is at the expense of the proximal ends of the feeding canals. Thus, the walls of the canals are directly continuous with the wall of the vacuole. The pore, vacuole and canals make a permanent continuous structure.

The canals are slender tubes varying in extent and size according to their disposition and the stage of contraction of the vacuole. At the end of systole, when the vacuole may be said to be collapsed, each canal is markedly bulbous in that portion immediately distal to the radiation from the vacuole. In such a stage the canals may be likened to long-handled Indian clubs radially disposed with their bulbous ends in close proximity. As diastole progresses, the canals present more nearly parallel sides throughout their length. Toward the end of diastole and the beginning of systole, the canals show distentions farther away from the vacuole.

There is no evidence that the contractile vacuole is formed by accessory vacuoles, as described and figured by Khainsky ('10), nor does any section show a pulsatorial papilla or evagination, such as he describes.

This study, therefore, indicates that the excretory apparatus of *Paramecium caudatum* is a permanent, continuous *structure*.

A detailed account with illustrations will be published later.

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[1] These observations were largely on serial sections of Paramecia fixed with Gilson, Bouin, Meves, Benda, Flemming and Altmann among others, including solutions of iodides (*e.g.*, Lugol's and 2 per cent. anhydrous iodic acid). The Altmann fixation gave by far the best results: absolutely no shrinkage; mitochondria, oil drops and cilia perfectly preserved. Of the various staining methods used, iron hematoxylin gave the best results. I am indebted to Dr. E. E. Just for turning over to me these slides, study of which served as a basis for these observations.

THE RESISTANCE OF THE TYPHOID BACILLUS TO FREEZING

IN spite of the published work of Pearse, Sedgwick and Winslow, Park and North, most text-books on bacteriology state that Eb. typhi will resist freezing for a considerable time; and quote Taylor's investigation of the historic Plymouth epidemic in support of their views.

In a series of experiments conducted in this laboratory during the past year, Mr. W. A. Kreidler, a graduate student, obtained results which clearly indicate that this hypothesis is incorrect. Using artificial culture media, water, sterile and normal feces as the media in which the organisms were frozen, he was unable to obtain any growth of typhoid bacilli or the "Paras" after freezing for three weeks.