

from a stem near that which gave rise to the Dinosauria.

The paper is an abstract, with some additions, of the memoir 'The Reptilian Subclasses Diapsida and Synapsida and the Early History of the Diaptosauria' (*Mem. Amer. Mus. Nat. Hist.*, Vol. I., November, 1903).

*On the Primary Components of Vertebrae and Their Relations to Ribs:* HENRY FAIRFIELD OSBORN. Read by title.

The vertebrae of the Stegocephala and of certain Permian Reptalia and the embryonic vertebrae of *Hatteria* establish beyond question the fact that there are four pairs of primary components, to which the names neurocentra, pleurocentra, hypocentra and hypocentra-pleurale may be given. Each is present in pairs on opposite sides of the notochord and neural tube. The 'neurocentra' correspond with the neural arches or neuropophyses of authors. The 'pleurocentra' (Cope) form the main components of the vertebrae in the Reptilia, Aves and Mammalia, and probably also in the Amphibia, although this fact has been questioned by Baur and Cope. The 'hypocentra' were first named by Gaudry, and subsequently termed 'intercentra' by Cope; they are primarily paired elements lying on either side of the notochord below and anterior to the pleurocentra; by Cope and Gadow it has been held that they form the main components of the vertebrae in certain if not in all Amphibia. The 'hypocentra-pleurale' (Fritsch) lie in pairs below and posterior to the pleurocentra; they are only found in certain Stegocephala. The vertebral complex thus made up is modified by the degeneration of the hypocentra-pleurale and in many forms of the hypocentra; by the development of the pleurocentra uniting with the neurocentra to form the centrum and neural arches.

Both on paleontological and embryolog-

ical evidence the ribs always rise primarily opposite the hypocentra; they are thus placed between the pleurocentra and may be described as 'intervertebral' or 'intercentral.' The capitulum of the rib is hypocentral while the tuberculum is pleurocentral in attachment. Secondly the capitulum may migrate to the side of the pleurocentrum, and the tuberculum to the side of the neurocentrum. This rib migration, observed independently in many different orders of reptiles, proves that the position of the head of the rib can not be adduced as evidence of the homology of that portion of the vertebral complex to which it is attached.

Mr. G. I. Adams, of the U. S. Geological Survey, read a paper entitled 'The Differentiation of the Permian in the United States, and the Diagnostic Value of Reptiles as Indications of Permian Age.' No abstract has been furnished.

Other papers by Messrs. J. C. Merriam, H. F. Osborn, Wm. Patten, E. S. Riggs, W. J. Sinclair and S. W. Williston were read by title.

Before adjournment Professor H. F. Osborn was elected president and O. P. Hay secretary for the ensuing year.

O. P. HAY,  
*Secretary.*

#### THE MEMBERSHIP OF THE AMERICAN ASSOCIATION.

THE following persons have completed membership in the association since the publication of the list contained in SCIENCE of December 25, 1903:

Adams, Charles Francis, Head of Science Dept., Central High School, Detroit, Mich.

Aitken, Robert G., Lick Observatory, Mount Hamilton, Cal.

Alt, Adolph, M.D., 3819 W. Pine Ave., St. Louis, Mo.

Andrews, Clement Walker, Librarian, The John Crerar Library, Chicago, Ill.

Banta, Arthur M., Instructor, Indiana University, Bloomington, Ind.

Barbour, Miss Carrie Adeline, Dept. Geology, University of Nebraska, Lincoln, Nebr.

Basquin, Olin H., Associate Professor of Physics, Northwestern University, Evanston, Ill.

Bell, John Everett, Care The Stirling Co., Barberton, Ohio.

Bierbaum, Christopher H., Consulting Engineer, 330 Prudential Building, Buffalo, N. Y.

Bigelow, W. D., Bureau of Chemistry, Dept. of Agriculture, Washington, D. C.

Bissell, G. W., Professor of Mechanical Engineering, Iowa State College, Ames, Iowa.

Bonnet, Frederic, Jr., 2719 Russell Ave., St. Louis, Mo.

Brooks, Charles, Botanical Laboratory, Univ. of Mo., Columbia, Mo.

Brown, Linus Weed, ex-Chief Engineer, City of New Orleans, 741 Carondelet St., New Orleans, La.

Browning, William, M.D., 54 Lefferts Place, Brooklyn, N. Y.

Burrill, Thomas J., Professor of Botany, University of Illinois, Urbana, Ill.

Burton, E. F., Demonstrator in Physics, University of Toronto, Toronto, Ontario, Canada.

Chamberlain, Clark Wells, Professor of Physics, Denison University, Granville, Ohio.

Cramer, Gustave, Pres. G. Cramer Dry Plate Co., St. Louis, Mo.

Crampton, C. Ward, M.D., 160 West 119th Street, New York, N. Y.

Curtis, Winterton C., Ph.D., Instructor in Zoology, University of Missouri, Columbia, Mo.

Daugherty, Lewis S., Professor of Biology, State Normal School, Kirksville, Mo.

Davies, Arthur Ernest, Ph.D., Ohio State University, Columbus, Ohio.

Detweiler, Andrew J., M.D., State Board of Health, Columbia, Mo.

Douglas, Archer Wall, 5101 McPherson Ave., St. Louis, Mo.

Earhart, Robert F., Asst. Professor Physics, Ohio State University, Columbus, Ohio.

Eikenberry, William Lewis, Instructor in Botany, High School, St. Louis, Mo.

Evans, Thomas, University of Cincinnati, Cincinnati, Ohio.

Eycleshymer, Albert Chauncey, Department of Anatomy, University of Chicago, Chicago, Ill.

Fischer, Charles E. M., Care Western Electric Co., 259 S. Clinton St., Chicago, Ill.

Folsom, Justus Watson, Instructor in Entomology, University of Illinois, Champaign, Ill.

Fox, Philip, Carnegie Assistant at Yerkes Observatory, Williams Bay, Wis.

Galloway, David Henry, M.D., Payette, Idaho.

Gazzam, Joseph M., Lawyer, 611-614 Real Estate Trust Bldg., Philadelphia, Pa.

Glasgow, Frank A., M.D., 3894 Washington Ave., St. Louis, Mo.

Gorham, Frederic P., Associate Professor of Biology, Brown University, Providence, R. I.

Gould, Charles Neton, Professor of Geology, University of Oklahoma, Norman, Okla.

Graf, August V., 1325-29 S. 7th St., St. Louis, Mo.

Greeley, Arthur White, Asst. Professor of Zoology, Washington University, St. Louis, Mo.

Greenway, James C., 667 Madison Ave., New York, N. Y.

Gunsaulus, Rev. Frank W., President Armour Institute, Chicago, Ill.

Hairgrove, John Whitlock, M.D., Jacksonville, Ill.

Ham, Miss Clara Eleanor, Instructor in Biology, Northfield, Mass.

Haukinson, Thomas L., Asst. in Biology, E. Ill. State Normal School, Charleston, Ill.

Hess, Selmar, Publisher, 122-124 Fifth Ave., New York, N. Y.

Huston, Henry A., 134 Laclede Building, St. Louis, Mo.

Jones, Arthur Taber, Instructor in Physics, Purdue University, La Fayette, Ind.

Kern, John H., M.D., 1317 Madison St., St. Louis, Mo.

Knab, Frederick, Entomological Artist, Urbana, Ill.

Knox, Geo. Platt, Teacher of Chemistry, 5178A Morgan St., St. Louis, Mo.

Landacre, Francis L., Associate Professor of Zoology and Entomology, Ohio State University, Columbus, Ohio.

Latham, Vida A., M.D., 808 Morse Ave., Rogers Park, Chicago, Ill.

Leith, Charles Kenneth, Professor of Economic and Structural Geology, University of Wisconsin, Madison, Wis.

Lewis, E. P., Associate Professor of Physics, University of California, Berkeley, Cal.

Lightner, Calvin R., M.D., 2313 Washington Ave., St. Louis, Mo.

Lischer, Benno Edward, 2313 Washington Ave., St. Louis, Mo.

Lutz, Frank Eugene, Assistant in Zoology, University of Chicago, Chicago, Ill.

Lyman, Elmer A., Professor of Mathematics, Mich. State Normal School, Ypsilanti, Mich.

McBeth, William A., Asst. Professor of Geography, State Normal College, Terre Haute, Ind.

McClure, Geo. E., 4418 Arsenal St., St. Louis, Mo.

McElfresh, William Edward, Asst. Professor of Physics in Williams College, Williamstown, Mass.

McKee, Ralph Harper, Professor of Chemistry, Lake Forest University, Lake Forest, Ill.

Mallinckrodt, Edw., Jr., 26 Vandeventer Place, St. Louis, Mo.

Marquis, J. Clyde, La Fayette, Ind.

Miller, Louallen F., Instructor in Physics, University of Wisconsin, Madison, Wis.

Mills, John, Instructor in Physics, Western Reserve University, Cleveland, Ohio.

Mohler, George H., Fremont Normal School, Fremont, Nebraska.

Neal, Herbert V., Knox College, Galesburg, Ill.

Nelson, N. L. T., Instructor in Botany, Central High School, St. Louis, Mo.

O'Donoghue, Martin, Westernport, Md.

Oleson, Olaf M., Fort Dodge, Iowa.

Pauls, Gustavus, St. Louis Altenheim, St. Louis, Mo.

Pearl, Raymond, Ph.D., Instructor in Zoology, University of Michigan, Ann Arbor, Mich.

Peters, Amos W., Instructor in Zoology, University of Illinois, Urbana, Ill.

Piper, Charles V., Office of Agrostologist, Department of Agriculture, Washington, D. C.

Porter, Albert B., 1232 Forest Ave., Evanston, Ill.

Poth, Harry A., Technical Brewer, 216 N. 33d St., Philadelphia, Pa.

Praeger, William Emilius, Department of Botany, University of Chicago, Chicago, Ill.

Priest, Henry, Ph.D., Dean of College of Letters and Science, St. Lawrence University, Canton, N. Y.

Proctor, Chas. A., Department of Physics, University of Missouri, Columbia, Mo.

Pyle, William Henry, Supt. Vandalia City Schools, Vandalia, Ill.

Rea, Paul M., Professor of Biology and Geology, College of Charleston, Charleston, S. C.

Reed, Howard Sprague, Instructor in Botany, University of Missouri, Columbia, Mo.

Riley, Cassius M., Professor of Chemistry in Barnes Medical College and Barnes College of Pharmacy, St. Louis, Mo.

Robertson, Charles, Carlinville, Ill.

Ruppert, G. E., 5 W. 86th St., New York, N. Y.

Sale, Rev. Samuel, 4010 W. Bell St., St. Louis, Mo.

Schaller, Waldemar T., U. S. Geological Survey, Washington, D. C.

Scherf, C. Harry, 114 Marietta St., Burlington, Iowa.

Schmucker, Samuel Christian, Ph.D., Professor of Biology, Normal School, West Chester, Pa.

Seaman, Arthur Edmund, Professor of Geology and Mineralogy, Michigan College of Mines, Houghton, Mich.

Segerblom, Wilhelm, Professor of Chemistry, Phillips Exeter Academy, Exeter, N. H.

Shibley, George H., 53 Bliss Building, Washington, D. C.

Shimer, Hervey Woodburn, Instructor in Geology, Mass. Institute of Technology, Boston, Mass.

Shull, George Harrison, Assistant in Botany, University of Chicago, Chicago, Ill.

Six, William Lewis, Philippi, W. Va.

Smith, Alice Maude, M.D., 327 North G St., Tacoma, Wash.

Sprague, Robert J., Knox College, Galesburg, Ill.

Stearns, H. D., Associate Professor of Physics in Stanford University, Stanford University, Cal.

Stickney, Malcom Enos, Instructor in Botany, Denison University, Granville, Ohio.

Stookey, Lyman Brumbaugh, Ph.D., Pathological Institute, Wards Island, New York, N. Y.

Summa, Hugo, M.D., Professor of Medicine, St. Louis University, St. Louis, Mo.

Taylor, Edson Homer, Teacher of Mathematics, Eastern Illinois State Normal School, Charleston, Ill.

Thornton, William M., Professor of Applied Mathematics, University of Virginia, Charlottesville, Va.

Townley, Sidney Dean, International Latitude Observatory, Ukiah, Cal.

Transeau, E. N., 220 S. Ingalls St., Ann Arbor, Mich.

Tucker, George M., Ph.D., University of Missouri, Columbia, Mo.

Tutton, Charles H., 140 York Street, Buffalo, N. Y.

Wackenhuth, F. C., Jr., Technical Brewer, 57 Freeman St., Newark, N. J.

Wallace, Robert James, Yerkes Observatory, Williams Bay, Wis.

Walton, L. B., Professor of Biology, Kenyon College, Gambier, Ohio.

Weidman, Samuel, Geologist, Wisconsin State Geological and Natural History Survey, Madison, Wis.

Wetzel, Reinhard A., Supt. Science High School, Fargo, N. D.

Wilcox, Guy Maurice, Professor of Physics, Armour Institute, Chicago, Ill.

Willett, James R., 434 W. Jackson Blvd., Chicago, Ill.

Williams, Frank Blair, Ph.D., Assistant Professor Civil Engineering, Union College, Schenectady, N. Y.

Wilson, Delonza Tate, Case School of Applied Science, Cleveland, Ohio.

Wiseman, Carl Marshall, Optician, 301 W. Chestnut St., Louisville, Ky.

Woods, Carl Fred, Dartmouth College, Hanover, N. H.

Zeleny, Charles, University of Chicago, Chicago, Ill.

#### SCIENTIFIC BOOKS.

*Ueber die Organization und Physiologie der Cyanophyceenzelle und die mitotische Teilung ihres Kernes.* Von E. G. KOHL. Jena, Gustav Fischer. 1903. Pp. 240, 10 plates. 20 mk.

This book, the result of several years of work on this interesting group of algæ on the part of Professor Kohl, will probably clear away definitely many of the clouds of doubt and contradiction over the structure of the cell of these plants. Professor Kohl applied his attention first to one species, *Tolypothrix latana*, until he had mastered the proper technique, and had acquired exact knowledge of its structure. Then he applied the same intensive study to *Anabæna catenula* and *Nostoc cæruleum*, afterwards testing his discoveries on a large series of the most diverse Cyanophyceæ.

Many points of structure, especially those bearing upon the shape and structure of the resting nucleus, as well as its behavior during division, were made the object of study in cells stained *in vivo*, as well as in cells fixed by various chemical reagents. The most important contribution to our knowledge is that in regard to the nucleus. The author confirms Bütschli's and Hegler's contention that the central body (Zentralkörper) is the nucleus. This organ occupies the center of the cell and runs out in numerous tapering branches into the surrounding cytoplasm, these processes

often extending to the cell wall. As ordinary fixation methods cause their immediate retraction, they usually have been overlooked. The nucleus has no definitely staining delimiting membrane, nor does it contain a nucleolus. In it, and in it alone, are contained certain granules named by Kohl 'centralgranules (Zentralkörner) and thought by him to consist of reserve stuffs. The apparent occurrence of these granules in the cytoplasm is explained by their being often found in the processes of the nucleus. Similarly, granules belonging in the cytoplasm sometimes appear to be in the nucleus, when they are imbedded in cytoplasm between the bases of the nuclear processes. The central granules are identified by Kohl with Bütschli's red grains, Nadson's Chromatinkörner, etc., and with the Volutanskugeln of the bacteria.

The cytoplasm contains various inclusions, chief among which are the cyanophycin granules (protein crystalloids), fat drops and certain semi-fluid bodies in the heterocysts which are found to fill up the pits in the cell wall at the point of attachment to adjoining cells.

According to many authors, this blue-green cytoplasmic mantle between the nucleus and cell wall is the single, cylindrical chromatophore. Kohl, however, combats this idea and considers as chromatophores the very numerous minute, colored bodies about  $0.6\ \mu$  in diameter scattered throughout the otherwise colorless cytoplasm. In their reaction towards stains they behave as do the chromatophores of higher plants. A study of the coloring matter of the cell shows that besides chlorophyll and phycocyanin, there is also always present carotin, the xanthophyll of many authors, which is never absent where chlorophyll is found, throughout the vegetable kingdom. It is the combination of these coloring matters in various proportions that makes possible the great variability of color of the different species, or even within the species of this group.

Instead of starch these algæ produce as carbohydrate the nearly related glycogen, storing it, apparently equally distributed, in the cytoplasm and not in granules.