SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

FRIDAY, MAY 15, 1908

CONTENTS

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE GENERAL MEETING OF THE AMERICAN PHILOSOPHICAL SOCIETY, APRIL 23–25, 1908

THE general meeting of the American Philosophical Society was held at Philadelphia on April 23, 24 and 25. The opening session was on April 23 at 2:30 P.M., and morning and afternoon sessions were held on the following days; with an evening lecture by Professor Henry F. Osborn on April 24, at the hall of the Historical Society of Pennsylvania, which was followed by a reception to the visiting members and friends of the society. The sessions were largely attended. The meeting closed with a dinner at the Bellevue-Stratford on the evening of April 25.

Forty-two papers were presented, covering a wide range of subjects. Among those relating to science were the following:

Cytomorphosis, a Study of the Law of Cellular Change: CHARLES SEDGWICK MINOT, of Harvard University.

Cellular change is in the direction of the differentiation of the protoplasm of the cell. As more and more of the undifferentiated protoplasm becomes specialized, the cell loses its plasticity to respond to exterior influences, and the power of the cell to reproduce depends upon the amount of undifferentiated protoplasm remaining. A blood corpuscle, for instance, which contains no undifferentiated protoplasm can not reproduce and must die. In muscle, on the other hand, the small amount of undifferentiated protoplasm remaining in the cell enables it to grow, and repair injuries.

Differentiation is the rule, and its end is the death of the cell.

Inheritance in Protozoa: Herbert Spencer Jennings, of the Johns Hopkins University.

Heredity has never been thoroughly studied among the Protozoa. This paper gives the results of an extensive experimental and statistical investigation of a number of generations of *Paramœcium*, raised from cultures and from "wild" forms. It has been assumed that the inheritance of acquired characters is normal among protozoa, though uncommon among higher forms. The author does not find that inheritance of acquired characters is more common in Protozoa than in Metazoa. "Wild" races of large or small size breed true to type, and in these the larger mate with the larger and the smaller with the smaller as a rule; when different sizes mate they produce different sized offspring, in the few cases where the mating is fertile. The production of new races does not readily occur by either inheritance of acquired characters, by selection or by mating.

Determination of Dominance in Mendelian Inheritance: Charles B. Davenport, of Cold Spring Harbor, N. Y.

In studying heredity, where a single character is considered which one parent possesses and the other lacks, or a character that is contrasted in the parents, it is generally found that the offspring are alike, and like one parent only. From examples of poultry, of insects, of certain mammals, including man, and certain plants in regard to inheritance that may be described as Mendelian, it is concluded that where a stronger determiner meets a weaker determiner in the germ, dominance is the result. When the character is present in one parent only, we have the extreme case and typical Mendelian inheritance, but when the determiners are of nearly equal potency the Mendelian law is obscured.

A Preliminary Report upon a Crystallographic Study of Hemoglobins: A Contribution to the Specificity of Vital Substances in Different Vertebrates: Edward T. Reichert and Amos P. Brown, of the University of Pennsylvania.

The primary object of this research was to determine whether or not corresponding albuminous substances are identical in different species. The results of the investigation, which has covered more than one hundred species of vertebrates, show: (*a*) the crystals of oxyhemoglobin obtained from any single genus are isomorphous, but unlike those obtained from other genera, unless these genera are closely related or in the same family; (*b*) specific differences in angle and habit are observed between crystals obtained from species of the same genus, so that it is generally possible to recognize the species by the crystals; (*c*) the occurrence of several types of crystals of oxyhemoglobin occur in the same species; (*d*) indications are found in the crystal angles of a substance in the molecule common to all hemoglobins, no matter what the system of crystallization. The application of this method of research to problems in zoological classification and in heredity was pointed out.

The Excretory Organs of the Metazoa, a Critical Review: Thomas H. Montgomery, of the University of Texas. (Read by title.)

The Effect of Certain Preservatives upon Metabolism: Harvey W. Wiley, of the U. S. Department of Agriculture.

Details were given of the work that Dr. Wiley is carrying on, in the study of the effect upon the human organism of a number of preservatives commonly used in the preparation of foods, such as borax, boric acid, salicylic acid and salicylates, sulphur-

ous acid, sulphites, benzoic acid and benzoates, formaldehyde, copper sulphate and potassium nitrate. Experiments with the first five of these preservatives show conclusively that their continued use, in quantities such as are used in food preservation, hinders or prevents metabolism, and may seriously derange the functions of the organism. The other substances enumerated are still under investigation, but the results thus far obtained seem to indicate that they are equally injurious.

Observations Regarding the Infliction of the Death Penalty by Electricity: E. A. SPITZKA, of Jefferson Medical College.

This paper sets forth the history of "electrocution," the methods employed and the phenomena observed in this mode of death, together with the post-morten findings; detailing the observations of the author, based upon 31 electrocutions at Sing Sing, Auburn, Dannemora and Trenton prisons. Compared with other methods, "electrocution" is the most humane method of inflicting the death penalty, because of its efficiency, quickness and painlessness, and it should be adopted in every state in the union.

Recent Discoveries in the Pathology of Rabies: MAZYCK P. RAVENEL, of Madison, Wis. (Read by title.)

The Brain of Rhinochimæra: BURT G. WILDER, of Ithaca, N. Y.

Four years ago Garman described a new species of chimæroid from Japanese waters, under the name of *Rhinochimæra pacifica,* giving a brief description of the brain, with figures showing the general form from the dorsum, venter and side. This paper gives a detailed description of the brain of this species, confirming Garman's findings and giving much additional data derived from dissection of the brain.

Preliminary Report on the Brains of the Natives of the Andaman and Nicobar Islands: E. A. SPITZKA, of Jefferson Medical College.

There is urgent need for research upon the anatomy of the brains of the exotic races, so rapidly becoming impure or extinct. Through the efforts of Dr. W. W. Keen, president of the society, enlisting the aid of Lord Curzon, Viceroy of India, Mr. Risley, ethnographer for India, and Dr. A. R. S. Anderson, senior medical officer at Port Blair, Andamans, the author was enabled to secure a brain of an Andamanese and one of a Nicobarese. The ethnic characters of these aborigines were discussed, and their brains compared as to size and structure with those of whites, Eskimos, Japanese, Chinese, negroes and Papuans, previously studied.

A Comparison of the Albino Rat with Man in Respect to the Growth of the Brain and the Spinal Cord: HENRY H. DONALDSON, of Philadelphia.

A statistical study of the growth of the brain and the spinal cord in the white rat, in which the weight of the brain and of the spinal cord is recorded and compared with the body weight at various stages of the development of the animal. The results are plotted, and from these records the logarithmic curves are drawn. When compared with the curves derived from the same data in the case of man and plotted to a corresponding scale, a close similarity in the curves is noted.

The Classification of the Cetacea: F. W. TRUE, of the Smithsonian Institution.

The paper deals with the classification of the toothed whales (sperm whale, beaked whale, porpoises, etc.) and has special reference to the fossil forms. The recent work of Dr. Abel, of Vienna, on fossil cetacea is reviewed and criticized. The opinion is expressed that the *Cetacea* are not directly

derived from Zeuglodonts, and that their origin is not at present known; also that the white whale and the narwhal should not be removed from the family Delphinidæ, and that the river dolphin, *stenodelphis,* should, for the present at least, be placed in that family.

Results of the American Museum Exploration in the Fayûm Desert of Northern Egypt: Henry F. Osborn, president of the American Museum of Natural History.

Professor Osborn gave an account of the American Museum expedition into the Fayûm Desert in search of the ancestors of the elephant. The formations explored were Middle and Upper Eocene. Bradnell and Andrews, between 1901 and 1905, had explored the region, finding ancestral forms of the Proboscidea and of the Hyracoidea, as well as primitive Sirenia and Zeuglodonts. The camp of the American Museum expedition was located to the west of Qasr el Sagra, near the bone quarries opened by Bradnell. Remains of *Arsinoïtherium, Palæomastodon* and *Mœritherium* were obtained from these quarries. A reconnoissance into the Zeuglodon Valley, near Gar el Gehannem, was described. The restorations of *Mœritherium* and *Palæomastodon,* made by Mr. Charles R. Knight, under the direction of Professor Osborn, were exhibited. From northern Africa the elephant stock migrated south through Africa, north into Europe, and northeast and east through Asia into the Americas. From a comparison of the ancestral elephant *Mœritherium,* with the Sirenian *Eotherium,* it is believed that the sea cows and the elephants are derived from the same stock.

Additional Notes on the Santa Cruz Typotheria: W. J. Sinclair, of Princeton University.

A presentation of the general conclusions reached, as a result of two years' study of the Typotheria from the Santa Cruz formation of Patagonia. They appear first in the *Notostylops* beds (uppermost Cretaceous or basal Eocene) and become extinct in the Pampean (Pleistocene). It is generally assumed that the rodents and conies are related to *Typotheria,* but this does not appear to be the case, the resemblances are probably due to convergence. The *Toxodontia* and the *Typotheria* probably had a common origin. The *Typotheria* do not lend much support to the idea of a former land connection with Africa, showing no relationship with the recently discovered Eocene mammals from the Fayûm province of Egypt.

Stratigraphic Observations in the Vicinity of Susquehanna Gap, north of Harrisburg, Pa.: Gilbert van Ingen, of Princeton University.

Details the results of field work that Professor Van Ingen has been carrying on along the Susquehanna River, above Harrisburg. The formations are found to contain well-preserved fossils and several typical faunas, as, for instance, the Hamilton, Ithaca, etc., are well developed. The findings of the author do not always agree with those of the Second Geological Survey of Pennsylvania, even in regard to structure, a great thrust fault recognized by the author, for example, has rendered the section incomplete, a fact not noted by the survey.

Further Researches on the Physics of the Earth, and especially on the Folding of Mountain Ranges and the Uplift of Plateaus and Continents, produced by Movements of Lava beneath the Crust, arising from Secular Leakage of the Ocean Bottom: T. J. J. See, U. S. Naval Observatory, Mare Island, Cal. (Read by title.)

Progress in the Demarcation of the Boundary between Alaska and Canada: O. H.

TITTMANN, Superintendent of the U. S. Coast and Geodetic Survey.

Details the methods employed in determining and marking the Alaskan boundary. The length of the boundary is about twelve hundred miles, extending from the Arctic Ocean south along the 141st meridian to near Mt. St. Elias, and thence along the coast strip of southeastern Alaska. In southeastern Alaska, aluminum bronze monuments are placed wherever it is practicable to do so, but, as most of the turning points in the line are inaccessible snow-clad peaks, they will be defined by triangulation, connecting with the work of the Coast and Geodetic Survey. The initial point on the 141st meridian, which is also being marked by monuments, was determined by a telegraphic longitude circuit, extending overland from Vancouver through Canadian territory, and by way of Seattle and the United States government cables, to Valdez and thence overland to the boundary.

A Living Representative of the Most Primitive Ancestors of the Plant Kingdom: GEORGE T. MOORE, Marine Biological Laboratory, Woods Hole, Mass.

Chodat has derived the green algæ from the Palmellaceæ. In this family he points out that there exist three principal stages or conditions: (1) the *Zoospore* condition, (2) the *Sporangium* condition, and (3) the *Tetraspora* condition. The author thinks that a better starting point is found in *Chlamydomonas,* which also shows three corresponding conditions, in addition to the Zoospore type, namely the *Volvox* type, the *Tetraspora* type and the *Endosphæra* type. The *Tetraspora* type of *Chlamydomonas* has developed into the *Palmellaceæ* and thence into the algæ and higher green plants. Even as high as the mosses and ferns a *Chlamydomonas* stage is to be seen in the male gametes.

The Influence of Heat and Chemicals on the Starch Grain: HENRY KRAEMER, of Philadelphia.

From a study of "reserve starches" and their behavior in relation to heat and chemicals, Professor Kraemer concludes: (*a*) The starch grain consists of two nearly related substances, the one a colloid, which takes up aniline stains, and the other a crystalloid, which becomes blue with iodine (*b*) The starch grain is made up of concentric layers, one series of which contains a large proportion of crystalloids, while the other alternate layers are composed mostly of colloids. (*c*) The polarization effects produced by the starch are attributed to the crystalloidal substance. (*d*) The starch grains retain their polarizing properties up to 180° C. (*e*) At the higher temperatures, in the case of the potato starch, the double refraction becomes stronger. (*f*) While heating the starch grains in water rapidly changes the structure of the grain, it is upon the addition of chemicals or ferments that denaturization is brought about.

A Contribution to the Knowledge of the Fungi of Pennsylvania; Gasteromycetes: D. R. SUMSTINE, Wilkinsburg, Pa.

This is the initial paper by the author giving a list of the fungi growing in Pennsylvania, and deals with the *Gasteromycetes.* Keys for the determination of orders, families, genera and species are given; about sixty species of *Gasteromycetes* are enumerated and their distribution is given by counties. The paper includes a bibliography of Pennsylvania mycology and a short sketch of the mycologists who have worked in this field.

Leaf Structures of the Bermuda Sand Strand Plants: JOHN W. HARSHBURGER, of the University of Pennsylvania.

The paper describes the adaptation of the leaf structures of the Bermuda sand

strand plants to the environment, as shown by a histological study of the leaves. The epidermal structures developed in the leaves to prevent transpiration and desiccation, brought about by the intense light and heat of the sun and the reflection of the white sand, are described and illustrated. Thickening of the cuticle, the development of water-storage tissue, and a hairy covering and the depression of the stomata are the principal changes brought about by the exterior conditions.

The Explosion of the Saratoga Septic Tank: William Pitt Mason, of Troy, N. Y.

The explosion of a tank used for the storage of sewage, and supposed to be due to the ignition of an explosive mixture of marsh gas and air, is discussed. The marsh gas is derived from the fermentation of the sewage, and the ignition is assigned to the generation of phosphine, which is supposed to have ignited spontaneously.

Some Chilean Copper Minerals: Harry F. Keller, of Philadelphia.

The author describes a number of raw minerals containing copper, from the mines in the Province of Tarapaca, Chile. Among these, the most interesting are peloconite, a manganese ore containing a considerable proportion of copper; a new double sulphate of copper and magnesium, isomorphous with chalcanthite; and a beautifully crystallized sulphate and arsenate of copper, which could not be identified with any known species. The author expects to follow this communication with others on minerals from Copaquira, Huiguintipa and other Chilean localities.

Absorption Spectra of Solutions: H. C. Jones, of Johns Hopkins University.

The object of the present investigation was to ascertain whether combination between the solvent and dissolved substances had any effect upon its power to absorb light. Certain salts in the anhydrous state have very different absorption than when combined with water. A solution of anhydrous neodymium chloride in absolute alcohol gives absorption bands differing from those obtained when a few per cent. of water is added. The application of this observation to the author's theory of hydration is discussed.

Effect of an Angle in a Wire Conductor on Spark Discharge: Francis E. Nipher, of St. Louis.

The problem to be solved is to determine the real current direction in a wire, through which a spark discharge is passing. The spark discharge was that of a long eight-plate machine. One terminal was grounded on a water pipe, the other was grounded in the air. A small wire bent at a sharp right angle was placed vertically in the lines of the earth's magnetic field, and so connected that the negative discharge could be sent either up or down around the angle and its effect recorded on a photographic plate placed under the angle. Very interesting photographic results were obtained, but the author does not consider that the main question was conclusively answered. The work is to be continued, using a platinum wire of .002 inch diameter. The electrometer will probably be a means for examining the two sides of the angle, and it can be used with a continuous current running through the fine platinum wire.

Some Results of the Ocean Magnetic Work of the Carnegie Institution of Washington: L. A. Bauer, of Washington.

Dr. Bauer described the work of the *Galilee* expedition in the Pacific since August, 1905. The work accomplished, briefly stated, is as follows: (*a*) magnetic observations have been made on the ocean areas which closely approach land observa-

tions in accuracy; (*b*) errors found in magnetic charts of the Pacific Ocean amount to from 1° to 5° in declination (or variation of the compass) and in dip, and about .04 in the horizontal magnetic force. The correction of such errors, especially the error in declination, is of great importance for the safe and rapid navigation of vessels.

The Investigation of the Personal Error in Double Star Measures which depend on the Position of the Angle: Mr. ERIC DOOLITTLE, of Philadelphia.

This paper gives the result of the determination of the constant personal errors, and also of the probable uncertainty of the measures, of double stars made during the past ten years at the Flower Astronomical Observatory of the University of Pennsylvania. Some eighty thousand single measures are available for the investigation. The double stars observed are divided into four classes and the law of occurrence of error deduced for each class. It is shown that for each class the personal error is well determined, so that from measures actually made the true value can be quite approximately determined.

Astronomical Photography: JOHN A. BRASHEAR, of Allegheny, Pa.

Dr. Brashear spoke of the advantages of the photographic over the visual method of astronomical observation, and rapidly sketched the history of the development of astronomical photography, from the time of Draper to the present. He also exhibited a number of photographs of celestial objects, such as star clusters, nebulæ, comets, the moon and planets, etc.; a large proportion of which were made with the 10-inch Brashear lens of the Bruce telescope of the Yerkes Observatory.

Relative Advantages of Various Forms of Telescopes for Solar Research: GEORGE E. HALE, of Solar Observatory, Pasadena, Cal.

Professor Hale discussed different types of telescopes for solar research, describing particularly the equipment at the Solar Observatory of the Carnegie Institution at Mount Wilson, California. The advantages of the fixed horizontal telescope with heliostat were pointed out. The author also described the large spectroheliograph of this observatory and exhibited a number of examples of photographs taken by means of this instrument, including solar prominences, faculæ, and sunspots.

Photographs of Daniel's Comet: E. E. BARNARD, of the Yerkes Observatory.

The comet was photographed on thirty-eight nights with the Bruce photographic telescope of the Yerkes Observatory. This is one of the brightest comets that have been visible since the great comet of 1882. It was visible to the naked eye for about two months during the summer. The photographs showed that the most active period in the comet's history occurred nearly a month before perihelion, at which time changes occurred so rapidly that the appearance of the comet changed from night to night. Indeed, on comparing the Yerkes Observatory photographs with photographs made at M. Flammarion's observatory in France, and at the Lick Observatory on the same night, marked differences in the photographs could be seen.

The Solution of Algebraic Equations in Infinite Series: PRESTON A. LAMBERT, of Lehigh University.

The object of this investigation is to develop a general method for determining all the roots of any algebraic equation, by means of infinite series. The method consists in forming algebraic functions of x from the given equation $f(y) = 0$ by introducing a factor x into all the terms but two of the given equation. These algebraic

functions are expanded into power series in x by the multinomial theorem, by Maclaurin's series, or by La Grange's series. If, in these power series, x is made unity, the resulting series, if convergent, determine the roots of the given equation. The convergency conditions determine in advance in which two terms of the given equation the factor x is to be omitted.

It is shown that all roots of the given equation can be determined by means of infinite series, derived by that method.

The Completion of the Lunar Theory and the Tables of the Moon's Motions to be made therefrom: Ernest W. Brown, of Yale University. (Read by title.)

Problems of Three Bodies on Surfaces: Edgar Odell Lovett, of Princeton University. (Read by title.)

Other papers of a general nature read at this meeting were the following:

The Law of Oresme, Copernicus and Gresham: Thomas Willing Balch, of Philadelphia.

The Dramatic Function of Cassandre in the Oresteia of Æschylus: William A. Lamberton, of the University of Pennsylvania.

Goethe's Private Library as an Index of his Literary Interests: Waterman T. Hewett, of Cornell University, Ithaca, N. Y.

Art and Ethnology: Edwin Swift Balch, of Philadelphia.

A Vedic Concordance: Professor Maurice Bloomfield, of Johns Hopkins University.

On the Lost Tribes of Israel and the Aryan Ancestry of Jesus and His First Disciples: Paul Haupt, of Johns Hopkins University.

The Sign and Name for Planet in Babylonian: Morris Jastrow, Jr., of the University of Pennsylvania.

Medieval German Sculpture in the Germanic Museum of Harvard University: Kuno Francke, of Harvard University.

Notes on Greek Vases in the Museum of Science and Art of the University of Pennsylvania: Professor William N. Bates, of the University of Pennsylvania.

The balloting for new members took place on Saturday morning, April 25, and those were elected whose names were printed in the last issue of Science.

The meeting concluded with a dinner at the Bellevue-Stratford, at which Vice-president William B. Scott, of Princeton, presided, and toasts were responded to by His Excellency, Mr. Wu Ting-fang, Dr. Horace Howard Furness, Professor William Gilson Farlow, Dr. Harvey W. Wiley and Hon. Hampton L. Carson.

The Applications of Physical Chemistry to Organic Chemistry[1]

To do justice to the subject, the "Applications of Physical Chemistry to Organic Chemistry," one would have to touch on all the chapters of organic chemistry: there is no branch of it that can not be put into more precise and therefore clearer terms with the aid of physico-chemical ideas. In the time at our disposal to-day it will be necessary for me to limit myself to a few illustrations.

We might begin with the simple device which we owe to physical chemistry of identifying a solid substance most positively by taking a melting-point not only of the substance itself, but also of a mixture of it and the compound it is suspected of being: this device was hardly known or used fifteen years ago and is now considered a more reliable and, certainly, a more rapid identification test than an exact ultimate analysis: I recall that in an investigation

[1] Address before the American Chemical Society, December, 1907.