lished in the *Journal of Morphology* during the year of 1911.

The Idiochromosomes in Ascaris felis: C. L. Edwards, 661 East 170th St., New York City.

Effect of Conjugation on the Stock in Paramecium: H. S. Jennings, Johns Hopkins University.

The Organs of Equilibration in Pelecypod Molluscs: Ulric Dahlgren, Princeton University.

The Anatomical Basis of Mulatto Color: H. E. Jordan, University of Virginia.

This paper will appear in the *American Naturalist.*

Variation in the Embryos of the Hagfish, Homea (Bdellostoma) stouti: Bashford Dean, Columbia University.

A New Phase of the Question of the Irritability of the Skin of Vertebrates to Chemical Stimuli: G. E. Coghill, Denison University.

The Comparative Toxicity of a Series of Electrolytic and Non-electrolytic Compounds with Respect to Fundulus heteroclitus: R. E. Sheldon, University of Pittsburgh. (Introduced by S. H. Gage.)

The Senses, Courtship and Mating in Tarantulas: A. Petrunkevitch, Yale University.

A Case of Regeneration in Tarantulas: A. Petrunkevitch, Yale University.

The Origin and Heredity of Four Wing Mutations in Drosophila: T. H. Morgan, Columbia University.

The Heredity of Red Eyes, White Eyes and Pink Eyes in Drosophila: T. H. Morgan, Columbia University.

The University of Michigan Biological Station: A. S. Pease, University of Michigan.

In addition to the papers read the following exhibits and demonstrations were presented:

Specimens of the 2100th Generation of Paramecium aurelia, attained without Conjugation or Artificial Stimulation: L. L. Woodruff, Yale University. (Presented by title only.)

On the Senses, Courtship and Mating in Tarantulas—Regeneration in Tarantulas: A. Petrunkevitch, Yale University.

Inheritance of Color in Colias philodice: J. H. Gerould, Dartmouth College.

Regeneration in Hydroids: H. V. Wilson, University of North Carolina.

Raymond Pearl,
Secretary

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION D—MINNEAPOLIS MEETING

The section held its meetings on Thursday and Friday of convocation week. The Thursday morning session was devoted to the routine business connected with election of officers and fellows and to a program of papers, ten in number, of which eight were devoted to road and highway problems. These papers were interesting and valuable contributions and should have been heard by a much larger audience than were in attendance.

Thursday afternoon the section met in joint session with Section B and listened to the address of retiring Vice-president Hayford of Section D on the subject "The Relation of Isostasy to Geodesy, Geology and Geophysics" and to that of Vice-president L. A. Bauer, entitled, "The Broader Aspects of Research in Terrestrial Magnetism." Both addresses have been published in full in Science and are well worth reading by those who heard them at the meeting as well as by others interested in the subjects. These sections have ever been fortunate in their vice-presidential addresses.

Thursday evening was given over to a dinner and smoker for the members of Sections A, B and D and the Chicago Section of the American Mathematical Society. The dinner was served by the Commercial Club of Minneapolis. The post-prandial remarks were enjoyed and enjoyable.

Friday morning Section D held a session devoted to Aeronautics at which nine papers were read by or for the authors. Quite appropriately the program opened with an appreciation of Dr. Octave Chanute written by James Means, of Boston, and presented by Professor A. Lawrence Rotch, vice-president of the section. This contribution will be printed in full in Science. On Friday afternoon, Sections A, D and the Chicago Section of the American Mathematical Society met in joint session for a symposium on engineering-mathematics, the same being a discussion of a preliminary report on the subject prepared by a committee appointed at the time of the Chicago meeting of the American Association for the Advancement of Science. Printed copies of the report had been prepared by the chairman of the committee, Professor E. V. Huntington, of Howard University, who opened the discussion, which was continued with spirit during the entire session with profit to all present.

Professor A. Lawrence Rotch, vice-president of

the association and chairman of Section D, presided at all meetings of the section and at the joint session of Sections B and D.

The officers for the Washington meeting of the section are as follows:

Vice-president—C. S. Howe, Case School of Applied Science.

Retiring Vice-president—A. Lawrence Rotch, Blue Hill Observatory.

Secretary—G. W. Bissell, Michigan Agricultural College.

Member of the Council—A. F. Zahm, Washington, D. C.

Member of General Committee—O. F. Marvin, University of Kansas.

Sectional Committee—J. E. Boyd, Ohio State University; A. H. Blanchard, Brown University; C. M. Woodward, Washington University; W. J. Humphreys, Mount Weather Observatory; G. O. Squier, U. S. A.

Herewith are titles and abstracts of the papers presented:

The Amount of Stream-flow in the Northern Prairies: E. F. CHANDLER, University of North Dakota.

In the prairie regions of the northern United States, there have been until lately no stream-flow records available. Within the past decade, the U. S. Geological Survey and other agencies have maintained fairly extensive records here. It is now known that in this region the stream-flow or "run-off" is far less than formerly supposed. In North Dakota, as a particular example, it is seen that some former estimates were as much as 500 per cent. in error, for the average annual run-off is less than one inch and the total of a single year is frequently less than one half inch.

The run-off from any drainage area depends upon its topography, geological structure, etc., and upon its total rain-fall and the seasonal distribution and intensity of the rains. But where the run-off is as small as here considered, it is very improper and misleading to follow the frequent custom of speaking of the run-off as a *percentage* of the rainfall.

The only basis upon which any reasonable estimates can be made is a comprehensive set of rain-fall and stream-flow records extending through a long period of years. Rain-fall records alone are not sufficient; this statement applies especially to regions where the stream-flow is only a small percentage of the rainfall.

Consequence of Solution of Air in the Hydraulic Air Compressor: F. W. MCNAIR and GEO. A. KOENIG, Houghton, Mich.

Brief description of the Taylor compressor at the Victoria Mine, difficulty with lights in the mine, plan of the mine, conditions due to "compressor air" as affecting lights and men, comment on efficiency of compressor, desirability of further investigation; being a brief résumé of the results of an investigation made in the spring of 1907 by the authors.

A Comparison of English and American Traffic Regulations: A. H. BLANCHARD, Brown University, and H. B. DROWNE, Providence, R. I.

From the standpoint of the highway engineer the following regulations should be made a part of the laws relative to the use of highways by various kinds of traffic. The proposed regulations are based on conclusions arrived at after a careful consideration of the effect of various classes of traffic on road surfaces as exemplified by American and European practice.

1. All horse-drawn vehicles shall be equipped with a light or lights.

2. All vehicles, either horse-drawn or motor-driven, having iron tires and using the improved state roads shall be provided with tires of widths such that for a 2-foot wheel 500 pounds shall be the maximum pressure per linear inch of width per wheel, but an additional pressure of 30 pounds per inch shall be allowed for each additional 3 inches in diameter. The maximum width of tires for horse-drawn vehicles shall be 6 inches. All iron tires must be smooth. The width out to out of all classes of vehicles, including the superimposed load, shall not exceed 8 feet.

3. The maximum speed of motor cars on all highways shall not be greater than is reasonable and proper, having regard to all classes of traffic and local environment.

4. Vehicles shall be so constructed that the driver or operator shall sit on the left rather than on the right.

5. Motor cars (including traction engines) hauling trailers shall keep to the right side of the center of the road. No more than three trailers shall be allowed in any train. Pneumatic tires or tires made of soft or elastic material shall not be equipped with chains, metal studs or some other non-skidding device of this character except in the case of passenger vehicles carrying not more than seven persons.

6. The intensity of powerful acetylene lights on motor vehicles, including those running on rails, shall be diminished on the approach of other vehicles.

7. Sign posts shall be erected by the state highway departments to give notice of points of danger and to give information as to the route of the road.

Relation between Modern Traffic and the Alignment and Profile in Highway Design: H. B. Browne, Providence, R. I.

Preliminary to designing a road, a careful study should be made of the existing traffic conditions and those to be expected, since there are several features in the design that depend upon whether a road is to serve only a horse-drawn vehicle traffic, a combination horse-drawn vehicle and motor-car traffic or a motor-car traffic alone. Wider roads are required where there is much motor-car traffic and on important roads a minimum width of twenty feet. is advocated. Also the transverse slope or crown of the road should be made from one fourth inch to one half inch per foot. Sharp curves are not detrimental to a road that takes mostly a horse-drawn vehicle traffic, but if a heavy motor-car traffic is expected all bad curves should be eliminated or reduced as much as possible, since they are not only expensive to maintain but are also extremely dangerous. Moreover, the curves should have a one-way slope up from the inside edge, as this will distribute the wear more evenly over the entire width of the road. There is no need of reducing the maximum grades now in common use on the improved roads.

The Present Status of the Use of Bituminous Materials in the Construction and Maintenance of Roads in the United States: A. H. Blanchard, Brown University.

As an indication of the development of the use of bituminous materials in road construction and maintenance, statistics are submitted based on the work accomplished by the state highway departments of Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York and Rhode Island. The total amounts of bituminous work in the various years are as follows: 1908, 350,000 sq. yds.; 1909, 7,750,000 sq. yds.; 1910, 18,000,000 sq. yds.

The most notable developments have been: (1) In the increased use of liquid asphalt and heavy asphaltic oils for surface treatment as is shown by the following figures, 1908, 208,000 sq. yds.; 1910, 2,434,000 sq. yds. (2) In the increased use of light oil as a dust layer, as is indicated by its non-employment in 1908, while 9,825,000 sq. yds. were treated in 1910. (3) The extensive use of asphalts, solid at ordinary temperatures, or combinations of asphalt and tar in connection with the penetration method of constructing bituminous pavements, the total square yards built in 1910 being 4,400,000 sq. yds., while no work of this character was done in 1908. (4) The increase in the use of liquid asphalts and heavy asphaltic oils in the construction of bituminous pavements by the mixing method, as is shown by the following figures, 1908, 3,000 sq. yds.; 1909, 151,000 sq. yds., and in 1910, 335,000 sq. yds.

Also attention is called to the more general use of refined tar in place of crude tar, the increased use of mechanical distributors both in the surface treatment of old roads and the construction of bituminous pavements by the penetration method and the introduction of mixing machines in connection with the construction of bituminous pavements by the mixing method on state highway work.

Certain Considerations affecting the Selection of Bituminous and Mineral Matter for Road Construction and Surface Treatment: J. C. Travilla, St. Louis, Mo.

Highway engineers are giving much attention to the investigation of bitumens and to the development of specifications for bituminous materials, but in the opinion of the writer insufficient attention is paid to the study of the mineral aggregate. The life of an asphalt or bitulithic pavement has been shown to depend upon the character of the aggregate to a great extent, and in the case of bituminous concrete or a bituminous wearing surface the same is true.

In general mineral dust is as objectionable as moisture in the construction of bituminous roads.

The wearing qualities of the mineral matter employed affect the life of a road and also the form of construction. In the case of a very soft stone better results ensue when the larger stone is placed on top.

The writer's experience proves to him that resiliency in the surface is of importance in lengthening the life of a road or pavement. Bitumens should, therefore, not be brittle at low temperatures nor should they be too soft at high temperatures. St. Louis has specifications governing the special adaptability and the methods of application for surface treatment of four grades of oil.

Care should be taken to keep oiled streets clean. The oiling of all road intersections is important in this connection.

Need of and the Opportunity for Technically-trained Men in Highway Work: A. N. Johnson, Springfield, Ill.

This paper reviews briefly the history of road

building in the United States, noting that from the time of the advent of railroad construction, little or no attention was given by engineers to road work until about 1890, when some of the eastern states took up the question of road improvement from state-wide view points, since which time large sums of money have been appropriated by different states for the systematic study and construction of roads; that this work is now demanding the service of trained men and the people generally are realizing the necessity of such service.

In presenting the paper, the writer illustrated with lantern slides some of the conditions found in highway work in Illinois and the methods of the road and bridge construction undertaken by the Illinois Highway Commission which would be representative of the conditions and methods applicable to a wide area of the Mississippi Valley region.

Methods of Taking Traffic Census on Highways: A. H. BLANCHARD and I. W. PATTERSON, Providence, R. I.

The value of statistics relative to traffic on highways, taken previous to their construction, is generally admitted; but the methods to be employed in the securing of such statistics have not been discussed in the technical press except relative to the classification of traffic.

In view of the fact of their close relation to the wear of a road surface, the following elements of classification should be noted: differentiation between horse-drawn and motor-car traffic, distinction between pleasure and commercial traffic, subdivision of commercial traffic into loaded and unloaded vehicles, weight per linear inch of tire of commercial traffic, number of horses drawing vehicle, weight and speed of motor cars and abnormal local traffic of extraordinary character. Numerous highway supervisory bodies have drawn up forms which include the above important items more or less completely.

The methods of securing traffic data are of extreme importance. The methods where two extremes of time (one year and one month) are available for traffic census are discussed. The following three methods applicable in both cases are considered: (1) observations upon single days at regular intervals; (2) observations through a period of several consecutive days at intervals; (3) observations covering a period of three days, including Saturday and Sunday, at intervals. The last-named method appears from the standpoint of economy of labor, probable clemency of weather (weather conditions at Providence, R. I., considered in each case for a period of five years), and results obtained to be the most practical method for general use.

The Present Status of the Relationship between Laboratory Tests and the Use of Road Materials: W. W. CROSBY, Baltimore, Md.

The science underlying the art of roadmaking is obtaining recognition. For its development, laboratory tests and records of experience are necessary. Some such have been available in the past, but these are, from their incompleteness, unsatisfactory now, especially as regards new materials and altered conditions of traffic. By reference to the records and use of such tests as those for the resistance to abrasion of stone and the cementing qualities of the stone powder, is shown the value of such tests, and, at the same time, the incompleteness of the present knowledge. More complete information is stated to be desirable as well as information along other lines, such for instance as the strength of stone under compression.

The changes in traffic conditions, and the new records of the experience with both old and new materials under the changed conditions are referred to with some suggestions as to what definite information may be desirable.

The statement is made that records from experience are needed, and not conclusions from assumed theories alone. Also that the author believes it may be possible eventually to reduce many of the problems of highway engineering to a mathematical solution. The beginning of the work of collecting information, and the desirability of cooperation are mentioned.

Dr. Octave Chanute and his Work in Engineering and Aeronautics: JAMES MEANS, Boston, Mass.

An appreciative review of the achievements of Dr. Chanute. (Published in full in SCIENCE.)

Permanent Winds, their Causes and Directions: W. J. HUMPHREYS, Washington, D. C.

The temperature difference between tropical regions and those of higher latitudes establishes a barometric gradient from the warmer to the colder parts of the earth. The resulting flow of the air together with the rotation of the earth causes the air of higher latitudes to flow from west to east, and that of the equatorial regions from east to west. The opposing centrifugal forces thus set up are the cause of belts of high pressure at latitudes 30° to 35° both north and south.

These belts of high pressure are underrun at five places, two in the Pacific Ocean, two in the

Atlantic and one in the Indian, by cold ocean currents. Hence, each of these five places is the seat of a permanent high or anticyclone with its attendant permanent circular winds.

An Indicator for Determining the Efficiency of Aeroplanes or Kites: S. P. Ferguson, Reno, Nev.

The author has devised a compact self-recording instrument for indicating continuously the angle of incidence and lateral inclination of an aeroplane or kite together with the velocity, and the lateral and vertical oscillations in the direction of the wind with reference to the flying machine upon which it is carried. This instrument is based upon the kite-meteorograph designed in 1905 by the author.

Determination of Altitudes of Aeroplanes by Triangulation: R. W. Wilson, Cambridge, Mass.

This paper contains an account of observations made by two methods to determine the maximum height reached by aeroplanes and a comparison of the results obtained at the Harvard Aviation Meet.

By one method observations were made with sextants in a fixed vertical plane which the aviator was to cross at his greatest altitude. Simultaneously observations were made by the other method in which theodolites were placed at the extremities of a base-line three miles south of the field.

Technical Education in Aeronautics: C. H. Peabody, Boston, Mass.

Technical education must eventually be offered for aeronautical engineers; the question is whether now is the time. The phases of this question are financial support, subject matter for instruction, method of securing teachers. The writer favors training a teacher for the purpose, and the establishment of undergraduate courses of instruction now. He offers a suggested course parallel to a course for naval architects.

A Program of Aeronautical Research Work, with Special Reference to what may be done at the Colleges: A. A. Merrill, Boston, Mass.

In this paper the work suggests four general lines along which research could be profitably conducted: (1) the problem of construction, (2) the problem of efficiency, (3) the problem of power, (4) the problem of stability.

In connection with each problem the author pointed out just what research work is necessary and to what extent the colleges are fitted to undertake this work.

Some Experiments on the Pressure of a Current of Air on Certain Surfaces: G. Lanza, Boston, Mass.

The paper explains the need of an apparatus consisting of a blower, for the production of a current of air, and of a tube for directing this current against the surface to be experimented upon. Also the means of obtaining a current free from gusts, and having a uniform velocity at all points of the cross-section of the tube.

Reasons are also given why the experimental surface should not be placed inside the tube, but should be located outside of and near its mouth.

The value of K in the formula $P = KV^2$ was found as a result of these experiments to be $K = 0.0031$, whence $P =$ pressure in pounds, and $V =$ velocity in miles per hour, the experimental surface being a plane surface one foot square, placed at right angles to the current.

The results are also given which were obtained by an investigation of the vortex formed under the prow of a surface formed to approximate the underside of the wings of certain birds, and placed at small angles of inclination to the current. The need of a larger apparatus of the same kind is urged.

The Increase of Wind-pressure on a Normal Surface with Height: A. H. Palmer, Hyde Park, Mass.

The increase of wind-pressure on a normal surface with increasing height is of considerable importance in aeronautical construction. From the known decrease of atmospheric pressure with height, and the wind-velocity in the free air obtained by means of kites and observations of clouds at Blue Hill Observatory, the wind-pressure in pounds per square foot upon a vertical plane has been computed and has been plotted in a diagram.

Normal Stress and Resultant Pressure: A. F. Zahm, Washington, D. C.

Extract from forthcoming book on "Aerodynamics" by Mr. Zahm.

Early Attempts to Navigate the Air: J. J. Green, Notre Dame, Ind.

Outline of history of aerial navigation from the time of Daedalus and Icarus through the middle ages down to the invention of the balloon. Scientific work done with the balloon. Its use by the postal authorities during the siege of Paris. Langley, Lillienthal, Chanute, Ader and their work; brief statements except in case of Ader's work.

G. W. Bissell,
Secretary

East Lansing, Mich.