

W. C. Sabine, of Harvard University, under the title of "The Origin of the Musical Scale." The address before Section C (chemistry) was given by Mr. Clifford Richardson, of the New York Testing Laboratories, on "A Plea for the Broader Education of the Chemical Engineer." There was no address before Section D (mechanical science and engineering). The address of the retiring vice-president of Section E (geology) was delivered by Dr. A. C. Lane, State Geologist of Michigan, at the summer meeting of the section held at Lake George. The address of the retiring vice-president of Section F, Dr. E. G. Conklin, of the University of Pennsylvania, was entitled "The Mechanism of Heredity." The retiring vice-president of Section G (botany), Dr. D. T. MacDougal, of the Carnegie Institution, Washington, D.C., discoursed on "Heredity and Environic Forces." The retiring vice-president of Section H (anthropology and psychology), Prof. A. L. Kroeber, of San Francisco, spoke on "The Anthropology of California." The address before Section K (physiology and experimental medicine) was given by retiring vice-president Simon Flexner, of the Rockefeller Institute for Medical Research, New York, on the subject "Recent Advances and Present Tendencies in Pathology." An address was given before the newly established Section L (education) by the Hon. Elmer Brown, United States Commissioner of Education, on "The Future of the Section of Education."

The character of the papers read before the different sections and the affiliated societies was of a very high order. A prominent feature of the meeting was the holding of joint sessions and symposiums on subjects of allied interest. The section on mathematics and astronomy, that on mechanical science and engineering, and the Chicago branch of the American Mathematical Society, for example, held an important joint session to consider the teaching of mathematics to engineering students, in which the present status in the United States was discussed by Prof. Edgar J. Townsend, of the University of Illinois, and in other countries by Prof. Alexander Ziwet, of the University of Michigan.

Section K held an important symposium on January 1 on the subject of immunity, in which the following papers were presented after introductory remarks by the vice-president of the section, Dr. Ludwig Hektoen, of the University of Chicago:—anaphylaxis and its relation to immunity, by Dr. M. J. Rosenau and Dr. John F. Anderson, of the United States Public Health and Marine-Hospital Service (paper read by Dr. Anderson); hyper-susceptibility and immunity, by Dr. Victor C. Vaughan, of the University of Michigan; the hæmolysins of animal toxins, by Dr. Preston Kyes; artificial immunity to glucosides, by Dr. W. W. Ford; the differentiation of homologous proteids by serum reactions, by Dr. S. P. Beebe; immunity in spirochætal infections, by Dr. F. D. Novey; immunity in Rocky Mountain spotted fever, by Dr. H. T. Ricketts and Dr. L. Gomez; virulence of pneumococci in relation to phagocytosis, by Dr. E. C. Rosenow; the mechanism of streptococcus immunity, by Dr. G. F. Ruediger; immunity in tuberculosis, by Dr. M. P. Ravenel; chemical aspects of immunity, by Dr. H. Gideon Wells.

The American Society of Naturalists, in the afternoon of January 1, held an important discussion on the topic of cooperation in biological research, in which Prof. F. P. Lillie, of the University of Chicago, Dr. W. Trelease, of the Missouri Botanical Garden, Dr. H. H. Donaldson, of the Wistar Institute, Dr. Simon Flexner, of the Rockefeller Institute, Prof. W. H. Howell, of Johns Hopkins University, and Prof. J. R. Angell, of the University of Chicago, took part.

Under the auspices of Section I an important symposium was held on the subject of federal regulation of public health. This session was held jointly with the National Legislative Conference of the American Medical Association and other interested organisations. Addresses were given by Dr. W. H. Welch, Hon. George L. Shiras, Dr. Charles A. Reed (president of the National Legislative Council of the American Medical Association), and Dr. F. F. Westbrook, of the University of Minnesota. There was also a lengthy prepared discussion by representatives of the various organisations concerned.

Section G and the Botanical Society of America held a symposium on the species question, in which the taxonomic aspect was discussed by Prof. C. E. Bessey and Dr. N. L. Britton, the physiologic aspect by Dr. J. C. Arthur and Dr. D. T. MacDougal, and the ecologic aspect by Prof. F. E. Clements and Prof. H. C. Cowles.

The American Chemical Society, as usual, held a very important meeting with a lengthy programme in joint session with section C of the American Association for the Advancement of Science.

As the result of a letter from the President of the United States, Mr. Roosevelt, to the president of the association, Dr. Nichols, concerning the necessity for active measures to conserve the natural resources of the United States, resolutions were adopted announcing the importance of such an effort, and appointing a standing committee of the association to consider plans and to forward the general movement. Resolutions were also adopted favouring an increase in the facilities given by Congress to the United States Bureau of Education. Further resolutions were passed urging the establishment of a research laboratory in tropical medicine in the Isthmian Canal zone; favouring the efforts to preserve from extinction the great sea animals of the waters adjoining the United States; and urging upon Congress the establishment of an Appalachian Forest Reserve, reiterating a recommendation urged at the last meeting of the association.

At the meeting of the general committee on the night of January 2 it was decided that the next regular meeting of the association be held in Baltimore during convocation week, 1908-9, and that a summer meeting be held in the week beginning June 29 at Dartmouth College, Hanover, N.H. A resolution was also adopted recommending that arrangements be made, if possible, for a meeting in the summer of 1910 in the Hawaiian Islands.

Officers for the present year were elected as follows:—president, Prof. T. C. Chamberlin, of the University of Chicago; vice-presidents, A, no election; B, Prof. K. E. Guthe, State University of Iowa; C, Prof. L. Kahlenburg, University of Wisconsin; D, Prof. G. F. Swain, Massachusetts Institute of Technology; E, Prof. Bailey Willis, U.S. Geological Survey; F, Prof. C. J. Herrick, University of Chicago; G, Prof. H. M. Richards, Columbia University; H, Prof. R. S. Woodworth, Columbia University; I, no election; K, Prof. W. H. Howell, Johns Hopkins University; L, Prof. G. Stanley Hall, Clark University; general secretary, Prof. F. W. McNair, president Michigan School of Mines; secretary of the council, Prof. D. C. Miller, Case School of Applied Science; treasurer, Prof. R. S. Woodward, Carnegie Institution, Washington, D.C. (as before); permanent secretary, Dr. L. O. Howard, Smithsonian Institution, Washington, D.C. (as before).

#### STRESSES IN MASONRY DAMS.

THE stresses in masonry dams, to which much attention has recently been devoted in our correspondence columns, formed the subject of three papers read before the Institution of Civil Engineers on January 21. In the first, Sir John W. Ottley, K.C.I.E., and Dr. A. W. Brightmore described some experiments, occupying about fourteen months, made with plasticine models of a dam of typical triangular section under perfect conditions. The height of the model was 30 inches, and the length of the dam 12 inches. From the results of the experiments the following conclusions were drawn:—(1) If a masonry dam be designed on the assumption that the stresses on the base are uniformly varying, and that these stresses are parallel to the resulting force acting on the base, the actual normal and shearing stresses, on both horizontal and vertical planes, would (in the absence of stresses due to such factors as changes in temperature, unequal settlement, &c.) be less than those provided for. There can be no tension on any plane at points near the outer toe. There will be tension on planes other than the horizontal plane near the inner toe, the maximum intensity of such tension being generally equal to the average intensity of shearing stress on the base, and the inclination of its plane of action being about 45°.

In the second paper Mr. J. S. Wilson and Mr. W. Gore

gave the results of an experimental investigation by means of india-rubber models. The following are some of the conclusions given:—(1) Tensile stresses may exist at the up-stream toe of a dam, notwithstanding the fact that the line of resistance lies well within the middle third. The tension may be reduced by (a) making the up-stream face vertical, or by otherwise increasing the weight of the dam toward that face; this would have the effect of increasing the stresses in the dam when the reservoir is empty; (b) by a general increase in the dimensions of the dam; (c) by placing an earth embankment against the down-stream face. (2) The direct stresses at the down-stream toe are compressive in every direction, but reduce to zero in the direction normal to the face. (3) The maximum compressive stresses in a dam above its foundations are in a direction approximately parallel with the down-stream face, and generally some distance therefrom. In magnitude they are slightly greater than

$$\frac{P_r}{\cos^2 \phi},$$

where  $P_r$  is the maximum normal pressure on a horizontal plane as determined by the trapezium law, and  $\phi$  is the angle between the resultant and the vertical. (4) The shearing stresses are considerable at or near the up-stream toe. They are a maximum a short distance from the down-stream face, in a plane approximately at  $45^\circ$  to the face. The maximum shearing stresses are in magnitude equal to

$$\frac{P_r}{2 \cos^2 \phi}.$$

(5) The stresses in the foundations are of less consequence than in the dam above the base, because of the lateral support and the more extended distribution. (6) The stresses are considerable at the toes of a dam if they form sharp angles with the foundations. These stresses may be reduced by replacing the angles with curves of large radii. The curve at the up-stream toe may take the form of a rounded quoin, cut in large stones, so as to avoid joints, in the masonry, normal to the direction of the greatest tensile stress.

In the third paper Mr. E. P. Hill described a method of determining stresses based on the assumption that the vertical pressure on the base varies uniformly from one side to the other.

#### AUSTRIAN SCIENCE.

THE monthly parts of the *Sitzungsberichte* of the Vienna Academy of Sciences which appeared last year show that there is no falling off in the research work carried out at the Austrian universities in the fields of mathematics and natural philosophy. Prof. Lecher, of Prague, has verified Ohm's law by showing that there is no difference in the resistance of a silver or platinum wire when a small or a large electric current passes through it, provided its temperature is the same in both cases. Assuming that the current is carried by one type of free electron, he deduces a velocity of propagation of electricity in ordinary cases of the order of a few centimetres per second.

Prof. F. Exner and Dr. E. Haschek have been engaged in a search for the cause of the slight variability of wavelength of many of the spectral lines with the method of excitation. They are disposed to attribute it to the lines for which it has been observed being complex, with satellites of variable intensity or number which appear to be present more frequently on the red than on the blue side of the line. In an instrument of only moderate resolving power, the apparent effect of any cause tending to increase the intensity of such satellites with respect to the original line will be a displacement of the line towards the red end of the spectrum.

Dr. N. Stücker has investigated the sensitiveness of a great number of persons to small differences of pitch in different parts of the musical scale. He finds that in general the region of maximum sensitiveness is in the octaves  $c^1$  and  $c^2$ , where about  $1/20$ th of a tone can be detected. A few musical people were able to detect a difference of  $1/200$ th of a tone in this region. The higher

limits of audibility varied from about 40,000 in general to more than 60,000 in the case of musicians.

The meteorological side of the activity of the academy is well represented by Dr. F. M. Exner's outlines of a theory of variation of atmospheric pressure. The principal result of this investigation is that the pressure variations may be represented by the motion of a relatively permanent system of isobars over the surface of the earth from west to east with a velocity varying slightly with the season.

An important series of papers by Prof. Rudolph Wegscheider and Dr. Heinrich Walter, published in the *Sitzungsberichte* (vol. cxvi., pp. 443, 455, and 533), throws a great deal of light on the phenomena occurring when soda is causticised by means of lime. On the one hand, the conditions of equilibrium for the reversible change  $\text{Ca(OH)}_2 + \text{Na}_2\text{CO}_3 \rightleftharpoons \text{CaCO}_3 + 2\text{NaOH}$  have been ascertained at different temperatures; that the change is a reversible one is shown by the fact that the same condition of equilibrium is established at a definite temperature whether the lime acts on sodium carbonate or caustic soda on calcium carbonate. The change in the direction from left to right seems to be more complete at  $80^\circ$  than at  $106^\circ$ – $110^\circ$ , and to occur more readily in dilute than in concentrated solutions; the way in which it is influenced by concentration is considered at some length from the standpoint of the theory of mass action. The loss of sodium carbonate which may occur in the more concentrated solutions owing to the formation of the mixed carbonate,  $\text{CaCO}_3, \text{Na}_2\text{CO}_3$ , is also fully dealt with, the conditions under which gaylussite,  $\text{CaNa}_2(\text{CO}_3)_2, 5\text{H}_2\text{O}$ , and pirsonnite,  $\text{CaNa}_2(\text{CO}_3)_2, 2\text{H}_2\text{O}$ , are capable of existence in contact with solutions of sodium carbonate and caustic soda being defined for different temperatures. It is noteworthy that the decomposition of both of the double salts by water is retarded owing to the formation of a protective sheath of insoluble calcium carbonate on the surface of the particles, so that if the mixed salt is once precipitated owing to the concentration becoming too great, loss of sodium carbonate may occur even though the insoluble material be well washed. The whole investigation has a special interest as illustrating the applicability of recently developed views in pure chemistry to the elucidation of technical problems.

During several years past the study of the general laws of esterification, especially of the influence exercised by structural peculiarities on the phenomena, has formed a special feature of the research work carried out under the direction of Prof. Wegscheider in the first chemical laboratory of Vienna University. The results obtained have, in particular, thrown considerable light on the nature of the so-called "steric hindrance." In continuation of these researches a series of papers by Anton Kailan appears in the *Sitzungsberichte* of the academy dealing with the esterification of the dinitrobenzoic acids, of mono- and di-hydroxybenzoic acids, and of pyridinemonocarboxylic acids by alcoholic hydrogen chloride. Prof. Wegscheider and E. Frankel discuss in considerable detail the reasons for abnormalities which sometimes are found to characterise the action of alkyl haloids on metallic salts of organic acids. The peculiar influence exercised by the presence of a small proportion of water on the rate of formation of ethyl chloride from alcohol and hydrogen chloride is the subject of a paper by A. Kailan, in which it is shown that the velocity constants of the action are proportional to the concentration of the hydrogen chloride only in absolute alcohol. In alcohol containing water, even in 99.9 per cent. alcohol, an increase in the concentration of the hydrogen chloride is found to be accompanied by a considerably greater increase in the velocity constant.

To vol. cxvi. of the *Sitzungsberichte* (*mathematisch-naturwissenschaftliche Klasse*) of the academy Mr. F. Siebenrock contributes a monographic revision of the American tortoises of the family Cinosternidæ, in which several changes in the generally accepted classification are proposed. In the British Museum Catalogue of Chelonians the family is taken to include only the single genus Cinosternum, while Claudius and Staurotypus are included with Dermatemydids in the family Dermatemydidae. This the author regards as an unnatural arrangement, and he proposes to transfer Claudius and Staurotypus to the Cino-