SCIENCE

VOL. LXVI AUGUST 26, 1927 No. 1704

CONTENTS

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal.

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 8, 1879.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

RENO MEETING OF THE PACIFIC DIVISION

THE eleventh annual meeting of the Pacific Division held at Reno, Nevada, June 22 to 24, 1927, was generally conceded to be a very successful one, especially from the viewpoint of the visiting scientists. That nearly 200 could be gathered together at a point so remote from population centers was considered a notable achievement. Credit is due President Walter E. Clark and his very efficient committee on arrangements, under the chairmanship of Professor Maxwell Adams, for the harmonious functioning of the various programs.

The outstanding event of the general sessions was undoubtedly the address of President Arthur A. Noyes on "The Periodic Relations of the Elements." This occurred on Wednesday evening, June 22, when after a charmingly cordial welcome by President Clark, of the University of Nevada, and the acknowledgment on behalf of the executive committee by Vice-president Joel H. Hildebrand, President Noyes launched into his theme.

The progression and recurrence of chemical and physical properties with increasing atomic number was considered in relation to the knowledge of the structure of atoms as developed within the past two years by spectroscopists and physicists.

A novel feature of the lecture was the presentation of a large colored chart showing the energy-levels and quantum relations of the constituent electrons in the various neutral atoms and in the ions resulting from them by successive losses of electrons. By frequent references to this chart, it was shown in general that these modern conceptions of atomic structure correspond to the well-known periodicity of properties; and in particular the extent was indicated to which these conceptions account for such properties as valence, ion-formation in crystals and solutions, and the radii of neutral atoms and of the ions in the solid states.

It is hoped that this address may be published for the benefit of members who were unable to attend the meeting as well as for the information of the interested public.

The Research Conference scheduled for the luncheon period of the second day was accorded more time than at previous meetings and embraced reports of recent achievements in research in Pacific Coast labo-

ratories. Each speaker briefly presented notable results in his field, the whole forming a fairly comprehensive view of scientific activities during the past year. In this way, Dr. Walter S. Adams, of the Mount Wilson Observatory, treated the subject of astronomy; Dr. Leonard B. Loeb, of the University of California, physics; Dr. R. E. Swain, of Stanford University, chemistry; Dr. Charles B. Lipman, of the University of California, botany; Dr. C. V. Taylor, of Stanford University, zoology, and Dr. P. J. Hanzlik, of Stanford University, medicine.

This method of presenting at one meeting a general review of the whole field of science met with great favor. It was felt that these research announcements must henceforth form a regular feature of the annual meeting. Such a "clearing house" in the hands of leading specialists should prove of great value in acquainting the scientist with what is engaging the attention of his fellows and perhaps lead in some degree to coordination of effort. One delegate vouchsafed the opinion that such a session might well be adopted as a feature of the annual meeting of the parent association.

A symposium on "The Scientific Problems of an Arid Region" was presented, with Gilbert Smith, professor of botany, Stanford University, Tracy I. Storer, associate professor of zoology, University of California, and J. Claude Jones, professor of geology, University of Nevada, as participants.

The address of Professor Henry H. Dixon, of the University of Dublin, was of absorbing interest. An abstract of Professor Dixon's paper on "The Nerves of Plants" follows:

From early times the cords of stringy tissue distributed through the parts of plants, especially through the leaves, have been called nerves. The general resemblance of the distribution of these cords to that of nerves in man and animals is sufficient apology for the name.

Later, when it was found their minute structure was wholly different and that they discharged functions wholly unlike those performed by the nerves, their appellation was changed. They were called veins—because they transmit fluids through the plant body; and, it may be noted, their peculiar structure allows these fluids to be dragged through them in a state of tension.

At the same time observation and experiment clearly showed that plants are sensitive to external stimuli and that often these stimuli are transmitted considerable distances in a plant from the point of reception to the place where the response is manifested. An outstanding example is furnished by the sensitive plant. A touch on the leaf-tip of this plant will cause not only the leaflets of the tip touched to fold up, but even the leaf-stalk to bend downward and also, after a short time, similar changes in the other leaves of the plant. Here the stimulus is transmitted in the plant for many inches.

The mystery of this was at first explained by adding it to the long debt already accumulated by the vital properties of the protoplasm—an admission of ignorance under the cloak of dogma. MacDougal in America and other investigators discredited this bill by showing that the stimulus is transmitted across dead tissues.

Ricca in Italy confirmed these observations and showed that the stimulus liberated a soluble substance into the stretched fluid in the capillaries of the veins. This is instantly dragged through the veins to the responding tissues.

It has also been shown that the stimuli of light, gravity and touch liberate *diffusible* substances in the tissues of other plants, and it seems certain that these substances are hurried in the same way through the wood *capillaries* to the point of response.

Thus the swing of the pendulum of scientific opinion has brought us to regard the vascular bundles of plants, if not as nerves, at least as channels for conveying messages from the point of reception to that of response.

Such material messages conveyed in the moving fluids of the animal body are well known. They are called "hormones."

With a total registration of 182 the attendance is hardly comparable with other meetings of the Pacific Division. However, it is to be noted that the registration was composed almost exclusively of scientists geographically distributed as follows:

Arizona	5
British Columbia	1
California, northern	81
California, southern	30
Colorado	2
Honolulu	1
Idaho	3
Ireland	1
Massachusetts	1
Minnesota	1
Mississippi	1
Nevada	25
New Mexico	1
Oregon	14
Philippine Islands	1
Quebec	1
Texas	1
Utah	6
Washington	3
Washington, D. C.	2
Wisconsin	1
	182

Reports received from the secretaries of societies holding sessions at the Reno meeting are presented as follows:

AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS, PACIFIC SLOPE BRANCH

(Roy E. Campbell, secretary, Alhambra, Calif.)

Although the attendance and number of papers were somewhat fewer than for several previous years, an excellent program was presented. Mr. F. B. Herbert told of a method of spraying for thrips which was almost as fast as dusting. Professor H. J. Quayle's paper on "Spraying and Fumigating Combination for Control of Resistant Red Scale" brought out the fact that neither spraying nor fumigation alone is entirely satisfactory in controlling the resistant red scale of southern California districts, but that a combination is successful. Moreover, fumigation following spraying is best, because the light oil-spray used loosens up the scales and forms a protective film on the foliage, so that the fumigation following kills the remaining live scales and does not injure the foliage. Professor Ralph H. Smith's paper on "Investigations and Arsenical Residue on Apples" showed that lead arsenate alone sprayed on small apples is soon sloughed off, but when used with a spreader remains on the constantly enlarging apple for a long time. Also there is a decided increase in the amount of arsenic on the apples after each spraying, which gradually decreases up to the time of the next application.

In the symposium held jointly with the Pacific Coast Entomological Society on the topic "Arousing Public Interest in Entomology," Roy E. Campbell mentioned some of the reasons for a greater public interest. Professor R. W. Doane's paper showed the importance of a more general knowledge of insects and disease in order to keep from becoming infected and also prevent insects from spreading disease. Mr. W. C. Jacobsen told how a more general knowledge of insects and an appreciation of their importance would help the quarantine officers in their efforts to prevent the introduction of injurious pests. Probably the most interesting paper on this topic was Mr. B. C. Cain's, on his work among Boy Scouts. The boys show a tremendous interest in nature, and the insects, with their variety of forms and colors, diversity in habits and their marvelous interrelationships, present a wonderful field for out-of-door study.

Dr. S. B. Freeborn's paper on "Efficient and Practical Control of House Flies" brought out the fact that several "fly sprays" were effective in keeping flies off of dairy cattle, but that their use actually reduced the production of milk, because of an accompanying rise in temperature and respiration in cows on which the material had been sprayed. Professor Doane in his paper on "Difficulties of Mosquito Control" showed that although mosquito abatement districts might clean up all the breeding places they were still subject to an occasional infestation due to mosquitoes being carried in by the wind from outside the district. Cooperation of all affected districts was the remedy suggested. Mr. S. J. Snow's paper on "Effect of Ovulation on Seasonal History of the Alfalfa Weevil" showed that beetles remained immature until fall or longer of their first season, and that eggs and larvæ found in the summer are retarded members of the old overwintering generation and not a partial new brood.

In Mr. Walter Carter's paper on "Isolation of Certain Yeasts and Allied Forms from *Eutettix tenellus*" the most interesting point was the mention of a new method of feeding sucking insects by the utilization of an animal membrane filled with the plant juices. This offers an artificial method of feeding sucking insects which has many advantages over the old method of using live plants, twigs or leaves.

Officers elected for the ensuing year are: *Chairman,* R. S. Woglum; *Vice-chairman,* Geo. M. List; *Secretary-Treasurer,* Roy E. Campbell.

THE AMERICAN CHEMICAL SOCIETY

(Geo. W. Sears, secretary pro tem.)

Western sections of the American Chemical Society united in a regional meeting as a section of the Pacific Division. Two sessions were held during which nineteen papers were presented by members from Washington, Oregon, California and Nevada.

"Essential Oils from Some Desert Plants" was discussed by Maxwell Adams. An unusually large proportion of desert plants contain volatile oils and many of the plants now cultivated for essential oils are natives of arid regions. Twelve varieties of plants were examined and the essential oils extracted by steam distillation and the physical constants of three were discussed at length.

"The Oxidation of Sulfides in Alkaline Solution," presented by Ludwig Rosenstein, brought the fact that sulfides in solutions whose sulfide-ion concentration is determined by the presence of carbonates and bicarbonates are rapidly oxidized by air in the presence of small amounts of nickel or cobalt sulfide catalyst. Sulfur is the principal reaction product, though thiosulfate and tetrathionate are also formed. The process has been applied to gas purification and has resulted in the production of an amorphous wettable sulfur useful for agricultural sprays.

"The Electrolytic Reduction of Sodium Nitrate," by H. K. Benson and J. L. Hoard, was presented by Dr. Benson. When sodium nitrate is electrolyzed fumes of NO_2 and NH_3 are evolved. Investigation of the nature and conditions affecting the reaction

brought out the fact that mercury was the most suitable cathode. The proportion of ammonia produced depends largely on the condition of the electrodes. With bright electrodes the reduction to ammonia was found to be very small, while tarnished electrodes gave nearly complete reduction to ammonia. Large scale operation showed 80 per cent. reduction to ammonia with 70 per cent. current efficiency. In discussing "The Carbonization of Sawmill Waste," by H. K. Benson and W. L. Beuschlein, Dr. Benson showed that sawdust could be converted almost quantitatively to charcoal in a rotary kiln, making use of a counter current air supply just sufficient to burn a fine-grained charcoal not spontaneously combustible.

"The Commercial Production of Port Orford Cedar Wood Oil," by Floyd E. Rowland, and the "Analysis of Port Orford Cedar Wood Oil," by P. H. Thurber, were presented by Mr. Thurber. Analysis showed 46 per cent. alpha pinene, 3 per cent. limonene, 26 per cent. borneol, 21 per cent. cadinene and 4 per cent. cadinol. The alpha pinene gave an optical rotation of + 53, which is much higher than the alpha pinene found in turpentine. Since there should be four alpha pinenes it was thought this was a different one from that found in turpentine. Since the oil proved to be different from the eastern product its commercial production will probably depend on extraction and utilization of the different components.

In discussing "The Mechanism of Light Rotation by the Asymmetric Carbon Atom," H. G. Tanner pictured a mechanical atom in which the asymmetry was caused by the forces holding the different groups rather than by the groups themselves. This conclusion was drawn from experiments with a mechanical model arranged to demonstrate the effect of polarized light.

"The Determination of Tantalum and Columbium," by Geo. W. Sears, presented the results of an attempt to apply the principles found in a previous investigation to be effective for separating the two elements to their quantitative determination. When an ore of tantalum and columbium is fused with sodium pyrosulfate at a temperature of 835–875° C. the tantalum is rendered insoluble in concentrated sulfuric acid, while the columbium remains soluble. If the fusion is made at a low temperature (about 600° C.) interfering elements can be removed by solution in hot 3N hydrochloric acid without dissolving any of the tantalum or columbium and the combined tantalum and columbium may be determined by igniting and weighing the residue obtained. By fusing this residue with sodium pyrosulfate and raising and holding the temperature at 835–850° C. for 12–15 minutes the tantalum is rendered insoluble in concentrated sulfuric acid.

"The Reactivity of the Fused Alkali Amides," by F. W. Bergstrom and W. C. Fernelius, illustrated the similarity between reactions in liquid ammonia and water solutions. Both the strongly electropositive and strongly electronegative elements react readily with fused potassium or sodium amide, while the elements of intermediate electroaffinity, such as nickel, copper and iron, exhibit little or no action.

In his discussion of "Low Students in Chemistry," R. A. Osborn showed that three fourths of the conditioned students, if given a review course, pass, although they remain poor students in the next course. It was a question, therefore, whether they should not have been required to repeat the course in class.

"Emulsification of Solid Powders," by J. H. Hildebrand, A. J. Scarlett and W. L. Morgan, extended to solid powders, such as lampblack and manganese dioxide, the work of Hildebrand, Draper and Finkle, who had shown, in the case of benzene-water emulsions, that the type of emulsion and its stability may be controlled by using different metallic salts of the fatty acids.

In discussing "Quantitative Treatment of Deviations from Raoult's Law," J. H. Hildebrand stated that in the opinion of many authorities, Raoult's law provides a better starting point for the development of systematic thermodynamic treatment of solutions than does Van't Hoff's classic law of osmotic pressure. In its simple form it applies to very few systems and the departures in many cases are too great to be brought into order by the modifications of Raoult's equation. It has been found possible to introduce an exponential factor, involving the gas content, absolute temperature and a specific constant for each system, into the ordinary equation of Raoult, which not only applies to all the regular systems (those which obey Raoult's simple law over some small range of concentration) but enables the solubility of one substance in another to be calculated at all temperatures if it is known for one temperature.

"A Laboratory Study of Nitrogen Fixation by the High Tension Arc," by H. V. Tarter and P. G. Cohen; "The Occurrence of Hydrogen Sulfide in the Lake Washington Ship Canal," by E. V. Smith and T. G. Thompson; "The Acidity of Waters of Some Puget Sound Bogs," by T. G. Thompson, J. R. Lorah and G. B. Rigg; "Improved Apparatus for the Removal of Dissolved Gases from Water," by J. R. Lorah and T. G. Thompson, and "Dissolved Gases in the Waters of Some Puget Sound Bogs," by G. B. Rigg, T. G. Thompson, J. R. Lorah and K. T. Williams, were briefly reviewed by Dr. Benson, who pointed out in connection with the first that the mass law holds approximately in the fixation of atmospheric nitrogen by means of the high tension arc and

that immediate cooling after passage through the arc is unnecessary.

Three papers were presented by E. C. Gilbert as follows: "The Freezing Point-composition Curves for the System Acetanilide-Propionanilide"—in the neighborhood of the eutectic an unstable compound is indicated by the flatness of the curve in that region; "Some Observations on an Arsenic Trisulfide Alcohol" showed that the coagulating power of ions of different valence obeyed the same general rule as in water, though the concentration necessary for precipitation was less than in water; "The Surface Tension of some Long Chain Fatty Acids in a Heavy Hydrocarbon Oil"—the surface tension as determined indicated that neither the hydrocarbon chain nor the acid radical of the fatty acid extended uniformly into the oil at the interface, but that many of the acid molecules must extend lengthwise along the surface of the oil.

At a dinner following the sessions, preliminary steps were taken toward the organization of the western sections of the American Chemical Society for the purpose of facilitating the arrangement of programs for regional meetings held in conjunction with the annual meetings of the Pacific Division of the American Association for the Advancement of Science.

AMERICAN PHYSICAL SOCIETY

(D. L. Webster, Stanford University, California, local secretary for the Pacific Coast)

The American Physical Society held two sessions, one a joint session with the Astronomical Society of the Pacific. As in most of the current meetings interest centered chiefly on spectroscopy and its application to problems of the structures of molecules and atoms, on the one hand, and stars, on the other. The aspects of molecular and atomic problems discussed at this meeting covered the whole range of such problems. There were, for example, the paper of Gibson and Ramsperger on the slow vibrations of atoms in the ICl molecule, that of King on the lines due to the valence electrons of the cerium atom, and those of Allison and Webster on the behavior of the innermost electrons in the atoms as deduced from intensity measurements by X-rays. In stellar applications of spectroscopy, interest centered on evidence from the sun, especially St. John's very careful and important revision of the solar spectrum tables.

In fields other than spectroscopic there were papers on a great variety of subjects, among which may be mentioned especially the work of Loeb and Du Sault, establishing the monomolecular character of the ions in acetylene, and the evidence presented by Brinsmade for the remarkable extent to which electrons may be reflected from metals without loss of speed.

ASTRONOMICAL SOCIETY OF THE PACIFIC

(Robert G. Aitken, secretary pro tem., Lick Observatory)

The Astronomical Society of the Pacific joined with the Pacific Division and held a very successful meeting. Members of the society from Stanford University, the University of Nevada, the Lick, Howell, Mount Wilson and Students' Observatories and from San Francisco were present, and the attendance of the two sessions for the presentation of scientific papers, held on Thursday, June 23, averaged 25. The 26 papers presented, as is evident from the program, covered a wide range, the sun and the major and minor planets and comets and satellites of the solar system coming in for discussion, as well as variable and binary stars, very cool stars (cool only by comparison with average stellar temperatures), and giant M stars. Practical astronomy was represented by papers on longitude determinations, on a horizon finding card and on a working model of an instrument for determining geographical points on the Sumner line at sea. Of special interest were E. C. Slipher's papers on the Lowell Observatory observations of Mars, Merrill's paper on a search for very cool stars, the paper by Adams and Joy on the relationship of spectral type to period among variable stars, Leuschner's report on the research surveys of minor planets, and Miss Losh's paper on magnetic storms and solar activity.

The Lowell Observatory has a long and honorable record in the study of conditions upon the planets of the solar system and Slipher's paper on Mars and also the one on Jupiter and Saturn showed that this study is being pursued with ever greater success by the application of modern methods of investigation. Of particular interest was the evidence presented of seasonal changes in color on the surface of Mars—most easily explained as due to the growth and decay of vegetation; of the existence in the atmosphere of Mars of impermanent features (clouds?) of two distinct varieties, one showing strongly in photographs taken in violet light, but feebly in those taken by red light, the other having just the opposite characteristics—facts which had been clearly brought out also by Wright's observations at the Lick Observatory in 1924 and 1926; and the evidence in favor of an atmosphere of greater extent than had been generally accepted prior to Wright's work in 1924.

Merrill finds that "the sequence of giant stars seems to terminate abruptly with a group of long-period variables of classes M6e to M8e, whose effec-

tive temperatures are slightly above 2,000° C. at maximum." Stars cooler than this are not known, though present observational methods are apparently competent to reveal them if they exist. "The fact that the coolest stars we know are all long-period variables may indicate a region of instability as the temperature approaches a limit set by some physical law."

In investigating the relationship of spectral type to period among variable stars, on the basis of a study of some 60 variables with the 100-inch telescope, Adams and Joy find, first, that "a large majority of the Cepheids, including all of the brightest and best known stars, show a very nearly linear relationship between spectral type and logarithm of the period." This relationship had been known before, in a general way, though no exact correlation had been established. The "rather surprising result" of extending the investigation to the short-period cluster-type stars and the long-period red variables is that, "on the average, these two classes fall close to the curve derived from the Cepheids.—The conclusion seems to be justified that the physical cause of the variation in light of these different classes of variable stars is similar and probably is to be ascribed to a periodic variation in size."

The paper by Leuschner and Thiele giving a progress report on the research surveys of minor planets was presented by the senior author and showed in striking manner how incomplete our knowledge of the minor planets still is. Ordinarily, it is stated that between 1,100 and 1,200 of these bodies are known. If every discovery is of a different object, the actual number of those that have been observed is more nearly 2,600, but the majority were so poorly or incompletely observed that they have been "lost"; even of those regarded as known only a small fraction have orbits sufficiently well determined to warrant the publication of observing ephemerides; and the number for which thorough orbital investigations are available is small indeed. Cooperative research, under the auspices of the appropriate committee of the International Astronomical Union, is now in progress, and in this Professor Leuschner and his colleagues at the Students' Observatory are taking a leading part.

A magnetometer for recording the range in the horizontal component of the earth's magnetic field was installed at the Mount Wilson Observatory in August, 1926. Miss Losh has compared the records of magnetic storms with the observation of sunspot groups and other evidences of great solar activity and finds the usual close correlation. For example, one of the largest complex sunspot groups of the year came round the east limb of the sun on September 12, 1926; a marked magnetic storm began on September 14 and continued until this group passed around the west limb. When the disturbed area on the sun reappeared, as the result of the solar rotation, a second and even greater magnetic storm occurred on the earth on October 13.

Space limits forbid further comment on these and the many other interesting papers presented. All the research observatories in the Pacific area, from Victoria to Flagstaff, have obviously had a successful year.

Members of the society participated in the general sessions of the division on Wednesday and Thursday, Dr. W. S. Adams, director of the Mount Wilson Observatory being one of the speakers at the "Research Announcements" luncheon on Thursday.

W. W. SARGEANT,
Secretary

(*To be continued*)

THE EMERGENCE OF THE BIOLOGY OF FOREST AND RANGE

THE rapid rise of interest in the biology of forest and range is an outstanding sign of the scientific times. While it is true that during the past two or three decades a few writers have called pointed attention to certain phases of the problems involved, most silviculturists, biologists and range research men have overlooked them. Of necessity, since the many partial problems merge into one big bio-ecological unit, the union of biology and forestry must be something more than a companionate marriage. It must be an old-fashioned and enduring alliance. The case is the same with biology and range research.

PRESENT TRENDS

The emergence of the biology of forest and range is associated with a new interest in all phases of the environmental relations of organisms. It is increasingly realized by biologists that these environmental relations are worthy of as close, consistent, prolonged, and quantitative attention as the phases of genetics and heredity which have been examined of late years with such illuminating and valuable results.

The following events may be cited as among those which seem to show a movement of interest and attention in the right direction:

The organization and activity of the Ecological Society of America, and the noteworthy success (at least along technical lines) of its official organ, *Ecology*.

Increased recognition by the United States Department of Agriculture, especially through the Bureaus of Biological Survey, Entomology, Plant Industry and the Forest Service, of the significance and im-