SCIENCE

VOL. 93 FRIDAY, MAY 16, 1941 NO. 2420

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

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal

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.

ANNUAL MEETING OF THE AMERICAN PHILOSOPHICAL SOCIETY

By Professor EDWIN G. CONKLIN

VICE-PRESIDENT AND EXECUTIVE OFFICER; PROFESSOR EMERITUS OF BIOLOGY, PRINCETON UNIVERSITY

THE American Philosophical Society held its annual meeting in its hall on Independence Square, Philadelphia, on Thursday, Friday and Saturday, April 24, 25, 26. The annual meeting of the council was held on the afternoon and evening preceding the session on Thursday. This was an innovation intended to give more time to the important work of the council than was possible heretofore when it met only at dinner on the evening preceding the executive session. President and Mrs. Morris entertained the council at dinner, which was given this time in the society's hall.

The program on Thursday morning and afternoon included thirteen papers in the physical and biological sciences, abstracts of which are printed below. On Thursday evening, Dr. Hugh S. Taylor, professor of chemistry at Princeton University, gave the Franklin Medal Lecture on "Large Molecules through Atomic Spectacles." The lecture was illustrated by models, slides and moving pictures showing novel conceptions of the structure of large molecules. The Benjamin Franklin Medal of the society was presented to Professor Taylor at the close of his lecture.

In the old days congenial members of this society used to adjourn to a Rathskeller or beer garden after an evening lecture, where light refreshment and light or heavy discourse were in order. These aftermath meetings were often most profitable and enjoyable. With the thought of reviving as far as possible this custom, round table parties were held in the hall of the society following Professor Taylor's lecture and

the opinion was generally expressed that they were both pleasant and profitable and should be continued.

The annual business meeting of the society was held on Friday morning at which the report of the president was presented, the proceedings of the council submitted and approved, reports of the committees on finance, research, publications and library received, and new appointments to committees announced. Report of the organizing committee on education and participation in science (adult education) was presented and its continuation recommended.

Officers, councillors and members were elected as given in the issue of SCIENCE for May 2.

Following the business meeting the open session was devoted to a general program on "Recent Advances in Psychology." J. McKeen Cattell, the Nestor of American psychologists, presided.

On Friday evening the program on psychology was concluded with the Penrose Memorial Lecture of Dr. Edward C. Tolman, professor of psychology, University of California, entitled "Motivation, Learning and Adjustment." This lecture was followed by a reception.

On Saturday morning five papers on archeological and historical subjects were presented. Saturday afternoon was assigned to an excursion to Valley Forge and its many historic monuments, and to a visit to the Cook Observatory at Wynnewood, where Mrs. Gustavus Wynne Cook graciously received the members and guests.

Luncheons were served each day of the meeting in the Hall of the Society, and the annual dinner was held on Saturday evening at the Bellevue Stratford Hotel, about two hundred members and invited guests being present. The John F. Lewis Prize of $300.00 and diploma for an important work that had been reported to the society and published in its journal, was awarded to Dr. George Howard Parker, professor emeritus of zoology, Harvard University, for his work on Neurohumors as Activating Agents. The citation was made by Dr. Detlev W. Bronk, professor of physiology, Cornell University Medical College, and Dr. Parker replied briefly. Harold C. Urey, professor of chemistry, Columbia University, then spoke on Rapid Changes in the Chemical Substances of the Human Body. He was followed by Frank Aydelotte, director of the Institute for Advanced Study, Princeton, who spoke on The Internationalism of Learning and the recent gift of $10,000 from the American Philosophical Society to the Royal Society of London for the promotion of science in Britain, and the exercises of the evening were brought to a happy close by an address from our long-time vice-president, Dr. Robert A. Millikan, director, Norman Bridge Laboratory of Physics, California Institute of Technology, on The Democracy of Science and the Duty of Scientists in This World Crisis.

Abstracts of papers presented at the various sessions follow.

Long enduring meteor trains: CHARLES P. OLIVIER.

Recent studies of cosmic rays at high altitudes: ARTHUR H. COMPTON. Our recent high altitude studies of cosmic rays have been concerned chiefly with the production of mesotrons. Photographs using a cloud chamber between the poles of a large, permanent magnet have been obtained in an airplane by G. Herzog and W. Bostick. These photographs show an abundance of slow mesotrons, which are exceedingly rare at ground level. We observe also the production of positive and negative pairs of slow electrons of roughly equal energy. Using counter tube assemblies carried in airplanes and by balloons, V. C. Wilson, W. P. Jesse, M. Schein and E. O. Wollan have observed the number of mesotrons and their rate of production by neutral rays at various altitudes. The rate of production is inappreciable below 6,000 meters, becomes strong at 9,000 meters, and continues to increase up to at least 20,000 meters. At the highest altitude, where the barometer is 2 cm of mercury, the number of mesotrons is at least as great as the number of incoming cosmic ray particles as estimated by Millikan and his collaborators. The possibility that the particles entering the atmosphere can be electrons seems to be eliminated by experiments measuring at high altitudes the number of particles capable of penetrating thick blocks of lead. It is observed that close to the surface of the atmosphere most of the particles which traverse 4 cm of lead are capable of penetrating 18 cm. This would not be true if they were electrons with the lower energy limit required for passing through the earth's magnetic field, for such electrons should be stopped by about 10 cm of lead. The results are, however, in accord with the view that the primaries are protons which are themselves capable of traversing the lead, or which on striking the nuclei of atoms in the air spend their energy in producing penetrating mesotrons or mesotron pairs.

Crystalline diphtheria antitoxin: JOHN H. NORTHROP. Diphtheria toxin forms a precipitate when mixed in certain proportions with serum from a horse which has been immunized against the toxin. This precipitate is a compound of the toxin and antitoxin. The compound is dissolved in slightly acid solution and the toxin digested by trypsin. The antitoxin remains in solution. About 30 to 60 per cent. of the original antitoxin may be recovered in this way. This "crude antitoxin" may be further separated by precipitation with ammonium sulfate at about pH 7.2 into three fractions. The fraction soluble in 0.35 saturated ammonium sulfate but insoluble in 0.65 saturated ammonium sulfate has a high antitoxic titre (700,000–1,000,000) antitoxin units per gram protein nitrogen 90 per cent. or more of the protein is precipitated by diphtheria toxin. It is strictly homogeneous in the ultracentrifuge with a sedimentation constant of 5.7×10^{-13}. It shows only one boundary at pH 7.3 in the electrophoresis cell but there is some reversible spreading.

This fraction corresponds probably to the highly purified preparations of Pope and of Pappenheimer and their collaborators. Solubility determinations show that this fraction is still quite inhomogeneous. Extraction of this fraction with 0.5 saturated ammonium sulfate at pH 7.2 yields a small amount of a protein which has constant solubility and is therefore probably a pure protein. This protein crystallizes readily in the form of poorly formed thin plates. The antitoxic value is unchanged after three recrystallizations. The protein is quite unstable under all conditions so far found.

On some reactions of tobacco mosaic virus: W. M. STANLEY. The most important reaction of tobacco mosaic virus is the one which results in virus reproduction, for it provides the basis for virus activity. Slight variations in this reaction appear to be responsible for the appearance of new virus strains which become apparent through the new diseases they cause. With the isolation of tobacco mosaic virus in the form of a reasonably homogeneous crystalline nucleoprotein, it became possible to study other reactions of this material and to determine the effect of such reactions on the basic reaction of virus activity. It was found that formaldehyde reacts with the amino groups and probably the indole nuclei of tobacco mosaic virus and causes loss of virus activity. With Dr. Miller, it has been demonstrated that most of the amino groups may be acetylated without interference with the basic reaction, hence it appears likely that the formaldehyde inactivation is not due to coverage of amino groups. In the present work it has been found that phenyl isocyanate reacts with tobacco mosaic virus and that about 3,000 phenylureido groups may be introduced into a single molecule of virus. The fact that the phenylureido derivative migrates as a single component in an electrical field indicates that approximately the same number of groups were introduced into each molecule of virus. The electrophoretic mobility of the derivative differs from that of untreated virus, and mixtures of the two can be separated readily. As expected, the sedimentation constant of the phenylureido derivative is essentially the same as that of the untreated virus. Antiserum to the phenylureido derivative gives a precipitin reaction with the derivative as well as with untreated virus. Electron micrographs prepared by Dr. Anderson and showing the reaction between tobacco mosaic virus and its rabbit antiserum will be presented. The introduction of the phenylureido groups was not found to affect the specific virus activity, and in a single experiment the virus isolated from plants inoculated with the derivative was found to have the normal value for amino nitrogen. This indicates that the alteration of the virus is not perpetuated in subsequent generations and, hence, that a large portion of the surface structure of the virus may be changed without interfering with the basic reaction of virus reproduction.

Quantum effects in evolution: GEORGE GAYLORD SIMPSON. Stability in a natural population of animals requires equilibrium of their genetics, structure and environment. A quantum effect in evolution is defined as the rapid transition from one equilibrium to another separated from the first by a definite span in which the population is or would be unstable and unadaptive. Paleontological data reveal apparent quantum effects that can surely be interpreted as mere deficiencies of record. There are, however, other and usually larger gaps in the record that are systematic and that coincide with major changes of adaptive level. Analysis shows that evolution during these changes must have been much more rapid than at other times, but that instantaneous change from one adaptive type to the other is improbable if not impossible. Analogous accelerations of rate on a smaller scale are demonstrated within recorded phyla. These provide concrete examples of effects postulated in recent work on population genetics, and they reveal the mechanism involved in minor quantum effects. The still greater rapidity of major quantum shifts theoretically requires that the populations concerned be smaller and more isolated. Their otherwise anomalously poor representation in the fossil record is thus to be expected and corroborates this theory, with which the positive features of the record also agree. There are three major modes of evolution: (1) speciation, typically by segregation of genetic variation stored in a population, as stressed by most geneticists, (2) phyletic evolution, typically by relatively slow and usually linear secular shifts of populations, as hitherto stressed by most paleontologists, and (3) quantum evolution as here defined and exemplified. The total pattern of evolution is a complex combination of these three modes.

New light on the origin of the Carolina "Bays": DOUGLAS JOHNSON. In a previous discussion before the Philosophical Society, evidence was presented to show that the supposed meteorite scars of the Carolina coast had been produced by normal terrestrial agents. The present discussion briefly reviews the hypothesis that the supposed "scars" are produced by artesian spring excavation accompanied by solution resulting in the formation of basins occupied by lakes, the waves of which built beach ridges about the borders of the depressions while dominant winds drifted sand to form the rims earlier attributed to meteoric excavation. Aerial photographs recently made available contribute new evidence in support of this hypothesis.

The Oligocene Mammalia of the White River: WILLIAM B. SCOTT.

Certain aspects of induced ovulation in the opossum: OLIN E. NELSEN. Ovulation may be induced in the opossum during the period of sexual rest or anoestrus by treatment with the follicle stimulating and luteinizing factors of the anterior lobe of the pituitary body. Luteinizing hormone derived from pregnancy urine appears to be equally effective when substituted for the luteinizing hormone of the pituitary body. A series of injections of the follicle stimulating factor (FSH) is given to stimulate follicular growth, followed by another series, to effect ovulation, of the follicle stimulating factor plus the luteinizing factor (LH). All injections are given subcutaneously. During the active reproductive period, with its recurrent oestrous cycles, the

induction of ovulation is more complicated. The FSH injections which stimulate follicular development, followed by the ovulating doses of FSH plus LH in combination, works well if applied during the dioestrous interval or during early prooestrus. Ovulation may be induced, however, by the combination of FSH plus LH alone, without the previous injections of follicle stimulating hormone (FSH) providing the injections are begun toward the end of prooestrus or at the onset of oestrus. To induce ovulation during the active sexual period, it is necessary, therefore, to know the actual stage of the oestrous cycle through which the animal is passing in order that the introduced hormones may be correlated with the natural cyclic changes. This information is gained by a careful study of the vaginal smear at the time the injections are begun and during the course of the injections.

Limited responses of melanophores as determined by activating agents. G. H. PARKER. In the skin of a pale catfish the large melanophores are represented by black spheres some 45 microns in diameter. In a fully dark catfish each such melanophore covers an area with a diameter of some 145 microns. The concentrated state of the melanophores is induced through nerve fibers that presumably discharge adrenaline (adrenergic fibers). The dispersed state is induced through either nerve fibers that probably discharge acetylcholine (cholinergic fibers) or through intermedine carried from the pituitary gland of the brain by the blood to the melanophores. If the pituitary gland is removed from a catfish, this fish can still darken but only partly (each melanophore can disperse its pigment to cover an area whose diameter is at most about 100 microns). This reaction must depend exclusively upon cholinergic fibers (acetylcholine). When additional acetylcholine is injected into such a fish, the melanophore pigment is not further dispersed. This is true even when enough acetylcholine is injected to kill the fish. If into such a partly darkened fish a small amount of intermedine is injected, the fish will then fully darken. Intermedine, if injected into a pale fish, will also completely darken it. Hence acetylcholine as compared with intermedine is capable of inducing only a limited and well-defined dispersion of pigment in catfish melanophores. The blanching agent adrenaline shows no such limitation in its action. It is noteworthy that acetylcholine in large doses is deadly to catfishes, but intermedine is not. What restricts the action of acetylcholine on the melanophores of this fish is not known. When under natural conditions a fish darkens, its melanophores are first excited through nerves (acetylcholine) and only subsequently does intermedine become an effective agent.

Self-sculpturing of bone: CHARLES B. DAVENPORT. The long bones of the palm of the hand and of the fingers have a nearly cylindrical column in the middle and a flaring head at each end. To the head are attached muscles for moving the fingers. In a child these long bones grow rapidly in length but *only* at the broad terminal surfaces. In this process the broad head as it is at any moment is immediately left behind and becomes incorporated in the slender column while new material is formed at the broad surface of the advancing head. This involves the absorption of the margins of the left behind part of the head and reconstruction of this part of the bone into part of the column. The ends of the finger muscles which are attached to the periosteum covering the head apparently move constantly to new positions as the new material advances. The resculpturing of the ends of the bones is beautifully and accurately done so that ordinarily no trace of the old head appears in the elongating shaft. In identical twins the sculpturing is done so accurately that exceedingly similar outlines of the bones of the hand result.

New mutational segregations from Oenothera mut. Erythrina de Vries: GEORGE H. SHULL. *Oe.* mut. *erythrina* de Vries, when selfed, is known to produce in every progeny two types, one repeating the parent, the other a new type, seg. *decipiens,* which breeds true when selfed because it lacks both of the balanced lethals which characterize *Oe. Lamarckiana. Erythrina* splits in this way because it has only one of the *Lamarckiana* lethals. Some years ago I reported the occurrence of a new mutational segregation in which mut. *pollicata* was found to characterize the *decipiens* component of such a splitting progeny, while normal hypanthium, styles and stigmas characterized the *erythrina* component. A continuation of studies with *erythrina* have brought to light a number of new segregations, sometimes replacing *decipiens,* in other cases being additional to *decipiens.* The first of these new mutational segregates was discovered on March 8, 1935, when family 3485, produced from a self-fertilized *erythrina* mother, was observed to split out 45 plants of a peculiar new type afterwards called seg. *petiolaris,* in a total progeny of 164. A complete analysis of this family showed it to consist of 70 *erythrina,* like the parent, 50 seg. *decipiens,* 43 seg. *petiolaris,* and 1 unidentified mutant. Over half of the *erythrina* plants in such a family repeat the three-way split when selfed, while the rest split only to *erythrina* and *decipiens.* On March 20, 1938, another remarkable new segregation, seg. *contracta,* was discovered in family 37428, derived from an *erythrina* mother in this same strain. The unique feature this time was not alone the remarkable modification represented by the new type itself, but seg. *contracta* replaces seg. *decipiens.* Family 37428 consisted of 61 *erythrina* and 40 *contracta,* no *decipiens* being present. Every *erythrina* plant in such a family produced the same kind of a family, consisting of *erythrina* and *contracta.* In 1939 another new segregate, seg. *diminua,* was found, and in 1940, still another, seg. *cyanea,* was added to a *contracta*-segregating family (39533) which split to 61 *erythrina,* 25 *contracta,* 16 *cyanea.* In 1941 one family (40110) from selfed *erythrina* has had the *decipiens* segregate replaced by seg. *elongata* and in another progeny (40130) seg. *retracta* has replaced seg. *contracta.* An essentially true-breeding *erythrina* has resulted when seg. *decipiens* is replaced by seg. *sublethalis,* the latter being rarely seen because it has so little chlorophyll that usually it does not live beyond the germination stage. This "non-splitting" *erythrina* was discovered in 1938 in family 37411, but seg. *sublethalis* was not observed until the current year (1941).

The mechanism and probable significance of the convulsions produced by cyanide: CARL F. SCHMIDT. In a series of earlier experiments in this laboratory, generalized convulsions were sometimes elicited in cats and dogs by reduction in the oxygen tension of, or by addition of cyanide to, the fluid used to perfuse the carotid bodies. The possibility, suggested by those experiments, that reflexes from the carotid and aortic chemoreceptors can set up in the central nervous system an excitation sufficiently powerful and widespread to lead to convulsions, has now been tested under conditions more closely approximating the normal by determining the influence of aseptic denervation of the carotid and aortic reflex zones on the convulsions elicited in dogs by intravenous injection of sodium cyanide (about 1 mgm per kilogram). In intact animals these convulsions were regularly produced, epileptiform in character, associated with complete unconsciousness, and followed by profound weakness and depression; alkalosis resulting from the vigorous hyperpnea which preceded the convulsions was not responsible for the latter because they also occurred when the animals were made to breathe air enriched with carbon dioxide. In one dog carotid denervation sufficed to render cyanide entirely ineffective: there were no traces of convulsions, consciousness was retained, and no visible weakness or depression ensued. In another, an identical result was obtained, but only after denervation of both aortic and carotid regions. In a third, convulsions were still elicited by cyanide after complete denervation of carotids and aorta. The situation therefore is not simple, but it seems clear that in some dogs, at least, strong stimulation of the carotid and aortic chemoreceptors can cause a violent generalized excitation in the central nervous system. A weaker excitation of this nature during anoxemia might assist in maintaining the activity of this system in the face of depression by anoxia; termination of anoxemia might then cause immediate unconsciousness and collapse.

The growth of cancer as observed experimentally in the anterior chamber of the frog's eye: BALDUIN LUCKÉ and HANS G. SCHLUMBERGER. The anterior chamber of the eye is an exceptionally favorable site for studying the phenomena of cancer growth. Here, because of the transparency of the overlying cornea, details of growth of transplanted cancer may be observed directly with the microscope as plainly as through a window; such direct observation may be complemented by microphotographs of the living tumor for permanent and objective records. The present experiments deal with the effect on the growth of cancer of two environmental factors known to be of major importance in determining normal growth, namely, surface forces and temperature. The cancer used in these experiments is an adenocarcinoma of the frog, which in structure and behavior resembles the most common kind of cancer in man and animals generally. This tumor readily becomes established in the eye, where it may be studied in successive generations. Such observations have led to the conclusion that the pattern of cancerous growth is influenced decisively by surface forces. Thus, if the outgrowths from the cancer extend into the cavity of the eye where they are completely surrounded by fluid, and where in consequence interfacial forces are equalized, the resultant form is cylindrical. If, instead, the outgrowths make contact with a firm surface such as the lens, the interfacial relations become such that the edges of the growing tumor are drawn over the lens, forming a spreading membrane. If, however, the proliferating tumor pushes into the clefts of a loose tissue, such as the iris, the invading cells become arranged as spheres or cylinders, again through the operation of surface forces. For studying the effect of temperature on the growth of cancer, the frog carcinoma is particularly good material. Since the temperature of the frog is that of the environment, the effects of temperature may be investigated over a far wider range (4° to 28° C.) than would be possible in warm-blooded animals. The experiments bring out that, as in normal tissue, the most striking effect is acceleration in rate of growth at higher temperatures and retardation at lower. Further, at higher temperatures there is more efficient vascularization, and the character of growth is different, the cancer forming long, branching outgrowths which tend to become distended with fluid. At lower temperature, on the other hand, the outgrowths are short, stubby and more solid. We conclude that the growth of cancer is affected by surface forces and temperature in the same general direction as is the growth of normal tissues. Cancer growth is governed by the same physical factors that govern normal growth.

Large molecules through atomic spectacles: HUGH S. TAYLOR. The highest resolutions now attainable with the electron microscope permit us to examine objects which are about 40 Ångström units in linear dimension. Interatomic distances are, however, of the order of 1 to 3 Ångström units so that to examine the geometry of the constituent units of molecules it is still necessary to construct and study models made to scale in accordance with the best data of physico-chemical science. The Fisher-Hirschfelder atomic models have proved especially useful in this problem of viewing molecules through atomic spectacles. The method of attaching atoms one to another provided by the makers of these models is not very satisfactory. A new method of attachment will be shown which makes complicated molecular models more rugged in the problem of construction and subsequent handling. Colored photographs of models of various molecular structures will be shown to exhibit features of molecular structure which are not immediately evident from the older structural formulae of the chemist. Photographs of molecular models will be used to illustrate structures proposed for various vitamins, hormones and protein materials, in particular those of hair and wool. A new method of folding a polypeptide chain to give the alpha-keratin structure which is superior to those hitherto proposed for these fibrous proteins will be given. Actual models of large molecules will be on exhibition.

Correlated developments in neurology and psychology: KARL SPENCER LASHLEY. Analysis of mental activities reveals that they can be described meaningfully only in terms of their organization. Studies of the integration of nervous activities in the cerebral cortex are finding

types of activity which have many of the characteristics of mental organization. The structure and electric potentials of sensory areas point to a complex interplay of interference patterns or of field forces in which structural elements are subordinate to the influence of masses of excitation. Psychological analysis of the mutual influence of sensory elements in the formation of precepts reveals laws of organization identical with those of physical force-fields. Thus neurology and psychology are approaching a common formulation of the laws of organization of their materials. In studies of motivation and of the variables contributing to intellectual activity there is a similar confluence of the two disciplines toward a common statement of principles of organization.

The genesis of behavior form in fetus and infant: ARNOLD GESELL. The morphogenesis of human behavior becomes apparent at an early fetal stage before the close of the second month of gestation. From the beginning behavior tends to assume characteristic *forms* and follows an orderly ontogenetic sequence. Premature birth does not alter the normal progressions. The behavior of 37 prematurely born infants with fetal ages varying from 28 weeks to 40 weeks was investigated by systematic developmental examinations, and cinema analysis. The behavior patterns of the premature infant approximate those of a fetus of equivalent age rather than those of a full-term infant of equal age. A film entitled "Infant Eyes and Hands" will be shown to illustrate the growth of behavior patterns and their characteristic forms at fetal and later maturity. Patterns delineated include the tonic neck reflex, primitive grasping, ocular fixation and progressive types of prehension culminating in precise thumb opposition. Behavior has shape in the same sense that limb-bud and finger prints have shape. The genesis of shape is similar for psychic and for somatic patterns. Form phenomena are found at all levels of organization beginning with molecular, colloidal and paracrystalline levels. Behavior forms stand at the summit of a hierarchical continuum. They are not unique manifestations of organization. They are end products of the same morphogenetic factors and forces which are being fruitfully investigated in the fields of biochemistry and experimental embryology. Experiential and environmental influences inflect and specify, but the primary, provisional and prospective components of pattern are intrinsic. Maturation is the net sum of the gene effects, and as such is the basic determinant of behavior form.

The nature of associations: WOLFGANG KÖHLER. In the classical theory of associations by contiguity the connection between two associated items seems to have been regarded as a neutral bond which remains the same whatever the items in question. More recently this theory has been modified both by Professor Thorndike and by Gestalt psychologists. Thorndike holds that a relation of "belonging" is necessary if two items are to become associated in consequence of their, single or repeated, contiguous occurrence. Gestalt psychologists maintain that the association of such items presupposes their organization within one experiential unit, and that the neural after-effect of such a unit *qua* unit is the fact of association. This Gestalt assumption leads to concrete inferences, because we know from perceptual experience what factors favor the formation of experiential units. Two such factors are similarity and proximity of the items in question, which means that similar items tend to form unitary groups, and that this specific interaction is more likely to occur if the items are neighbors in space and time (contiguity = proximity). The Gestalt interpretation of associations leads therefore to the consequence that, other conditions being equal, similar items will be more strongly associated than items which show no particular resemblance. In several experiments this expectation was fully verified. In fact, the influence of similarity on association is so strong that even very small statistical samples demonstrate it with great consistency. Organization, however, depends upon other factors besides similarity and proximity. At the present time experiments are being undertaken in which the influence of such other factors is tested. In this fashion it may be possible to decide whether an association actually constitutes a neutral connection or whether association is a product of specific interaction between the items in question.

(To be concluded)

OBITUARY

CARY LEROY HILL

CARY LEROY HILL, senior forester of the California Forest and Range Experiment Station, U. S. Forest Service, died on February 26, 1941, at the age of sixty-six. He was one of the true pioneers in American forestry, since he first entered government employment for summer forest work in 1904, and had served his profession continuously for 36 years until his retirement a few months before his death.

Mr. Hill was born at Howell, Michigan, in 1875 and, after graduating from high school, had a varied experience before settling down to his life-calling. He worked for three years for a stove manufacturer, both in Michigan and New York City, in order to finance his college course. After graduation from the University of Michigan in 1901 with a classical A.B. degree, he taught English and mathematics for a year at the Owosso, Michigan, high school. Going west on a summer excursion he stayed to explore the Cascade Mountains in Washington with the Geological Survey, and spent the following winter on the circulation staff of the *Seattle Post-Intelligencer,* "doing" the lumber camps of the Puget Sound region. It was during this western experience that he became interested in the forests and in 1903 returned to his alma mater to attend the forestry school which was just being estab-