both the spined and the smooth skeleton spicules, thus providing connecting links between the two formerly supposed distinct species.

In March, 1927, Dr. V. M. Tanner sent me some small specimens of *Spongilla fragilis* collected in the Wasatch Mountains in Utah in a small fresh-water pond at an elevation of 7,800 feet. The gemmules of this sponge are found in two very distinct arrangements in different parts of the sponge: in one case, they are scattered through the sponge structure, being grouped together in the typical *S. fragilis* groups of from three to several gemmules with their pore tubes projecting through the covering layer of materials; in the other case, the gemmules form a continuous layer one gemmule thick, closely bound together by a layer of spongin through which the long pore tubes with their curved ends project.

Dr. Jacques Rousseau, of Quebec, kindly sent me several specimens of a deep green sponge forming short cylindrical growths independently and also around the stems of a water weed. This was collected August 8, 1926, and contained no gemmules, but is readily distinguishable by its form and its flesh spicules as *Spongilla lacustris*. This material was collected from Lake Montauban in Quebec Province. Later on, August 17, 1928, Dr. Rousseau also collected this same species at an elevation of 3,650 feet from Lake Cote, Shikshok Mountains in the Province of Quebec, Canada.

Dr. Charles P. Sigerfoos, of the University of Minnesota, has given me a specimen of sponge collected near Minneapolis, Minnesota. This was very full of gemmules and proved to be an *Ephydatia mülleri* with thin smooth skeleton spicules.

Professor W. H. Cole, of Clark University, Worcester, Massachusetts, has kindly sent me recently a collection of sponges which he made from Sudbury River, Concord, Massachusetts, in September, 1924. This sponge he had already correctly identified and reported as *Spongilla lacustris*.

Dr. S. F. Light, of the University of California, has kindly sent me on separate occasions two small specimens of fresh-water sponges from California. The first one is an interesting form of *Ephydatia fluviatilis* with skeleton spicules varying from smooth to finely spined ones. No special location nor date is recorded on this specimen. The second specimen is from Noyo River, Central Mendocino County, and was a "vivid green in life." This sponge was collected in August, 1929, and has no gemmules in it. While there is some doubt as to its determination on account of the absence of gemmules, it is doubtless a species of *Carterius* and I am inclined to believe that it is *C. tubisperma*. Later collections bearing gemmules will be necessary before a final determination can be reached.

Dr. J. G. Needham, of Cornell University, has recently sent me a small collection of sponges made during the month of July, 1930, in the state of West Virginia. Fortunately most of these specimens can be satisfactorily identified, for they bear gemmules. One of these specimens is a very beautiful lichen or liverwort-like growth closely attached to the surface of a stone as a thin, branching form. This is *Trochospongilla leidyi* and it was collected from a stream near Justice, West Virginia. Another small specimen of the same species forming a thin crust on its support was taken at Guyandotte River, also near Justice.

A specimen of the typical form of *Trochospongilla* (*Tubella*) *pennsylvanica* was found in Elk Garden, Mineral County, West Virginia. A good collection of green *Spongilla lacustris* growing in masses rather than in cylindrical projections was taken from Greenbrier River, Marlington, West Virginia. Another specimen of sponge was collected from the Cacapan River near Wardensville, West Virginia, but since this bears no gemmules and presents no distinctive characteristics to enable one to identify it, I shall not hazard a guess even as to its genus. The skeleton spicules are smooth, of medium size and bear sharp points at their ends.

N. GIST GEE

ROCKEFELLER FOUNDATION,
PEKING, CHINA

THE NATIONAL ACADEMY OF SCIENCES

AT the annual meeting of the National Academy of Sciences, held in Washington on April 27, 28 and 29, the following papers were presented:

Molecules in the sun's atmosphere: HENRY NORRIS RUSSELL. It was once supposed that the sun's atmosphere was too hot to permit the formation of chemical compounds, but six have now been detected over the photosphere and eight more above the spots. The heat of formation of a number of these compounds is known (from their band spectra) and their dissociation in the sun and stars can be discussed in the same manner as the ionization of atoms. The results are in good agreement with observation. In general, the compounds increase in number and amount at low temperatures. Most of the known compounds contain hydrogen—the most abundant constituent of stellar atmospheres. Oxygen—also very abundant—comes next on the list. The carbon compounds CN and CH show a maximum at temperature a little lower than the sun's. This may be explained if oxygen is in excess, for CO is more firmly bound than the other compounds, and at low temperatures most of

the carbon would go into it. In the cool stars of classes R and N the carbon bands are very strong, as they should be if there is more carbon present than oxygen (confirming a conclusion of the late Professor R. H. Curtiss).

Discovery of three thousand southern double stars at the Lamont-Hussey Observatory of the University of Michigan, at Bloemfontein, South Africa: MORRIS K. JESSUP (introduced by Heber D. Curtis). This observatory, initiated by Dr. W. J. Hussey and established in South Africa through the generosity of Mr. Robert P. Lamont, started a double star discovery program on May 8, 1928. Work at this and other observatories of American origin has been greatly furthered by the friendly generosity of the South African people. The program of observing has been largely concentrated on the discovery of new double stars, systematic searching being carried on to a limiting magnitude of 9.5 in the Cape Photographic Durchmusterung. Good pairs fainter than this limit were not rejected, however. The limits of separation are determined by the formula log $p'' = A - Bm$, where $A = 2.8$, $B = 0.2$, and m is the visual magnitude of the primary. The observing has been done by three astronomers for the University of Michigan: Dr. R. A. Rossiter, chief observer, and Messrs. Morris K. Jessup and Henry F. Donner. The total production, soon to be published as a volume at Ann Arbor, is made up as follows:

Observer	Total discoveries	Known pairs remeasured	Total measures	Stars observed	Measures per star
Rossiter	1290	165	3336	1455	2.29
Jessup	988	436	3715	1424	2.61
Donner	738	265	2650	1003	2.64
L–H O	3016	886	9701	3882	2.50

Nights wholly or in part suitable for observing at Bloemfontein average about 250 per year.

The determination of the ozone in the upper atmosphere by bolometric measurements: OLIVER R. WULF (introduced by C. G. Abbot). Measurements of the transmission of visible light by ozone have been made on the solar spectrobolometer of the Smithsonian Institution at Table Mountain, California. A large glass cell, placed in the path of the sun's beam before the first slit of the instrument, was filled with controlled amounts of ozone and the weakening of the spectral intensity observed. Some forty satisfactory points for measurement have been chosen, scattered over the visible portion of the solar spectrobologram. These include points on both sides of the region of ozone absorption as well as within it. Using these, it has been possible to define a useful area which is proportional to the amount of ozone in the path, and which is determinable from transmission coefficients. This affords a basis for the determination of the amount of ozone in the upper atmosphere from direct bolometric intensity measurements.

Contact invariants: EDWARD KASNER. The author studies invariant properties of families of curves, or differential equations, under the total group of contact transformations. This includes the group of point transformations as sub-group (topological differential invariants as developed by Blaschke). Among families of ∞^3 curves, the *cubic type* is the simplest, including an interesting *anharmonic type* which is here introduced. Two families of ∞^2 curves (this configuration is termed a *wex*) have invariants. The simplest type of *wex* is defined by a generalization of the Desargues property. An absolute invariant of five differential elements of third order is found. Families of $\infty^2 + 3\ \infty^1$ curves are also introduced with a generalized hexagonal closure property. In conclusion, the author's theory of conformal invariants of horn angles is extended to both the topological and contact groups.

The present status of the telephone art in the United States, and some suggestions for future developments: GEORGE O. SQUIER. When Stephen Gray, an English scientist who died in 1736, discovered the copper wire to guide electricity he made one of the greatest inventions of all history. The telephone system in the United States now controls enough of this wire to reach half way from the earth to the sun. Under present management this vast wire pattern remains dumb and silent except for a few minutes each day. The present radio congestion in our planetary ether demands that Gray's invention be applied in furnishing educational programs free of advertising into the homes of the American people.

The effect of pressure on the quantum anomalies of ammonium chloride and bromide: P. W. BRIDGMAN. Simon has found anomalies in the specific heat of NH_4Cl and NH_4Br at atmospheric pressure at about $-30°$ Centigrade which are not allotropic transitions in the ordinary sense, since there is no change of crystal lattice, but which have been thought to be due to some quantum change, perhaps the acquiring of rotational energy by the molecule. Accompanying the anomaly of specific heat, there is also a volume anomaly of different signs in the two cases, the volume of NH_4Cl increasing anomalously as temperature is raised, while that of NH_4Br decreases. This leads to the expectation of a pressure effect, and this has, in fact, been found. At 0° Centigrade the anomaly in NH_4Cl begins at a pressure of 3,370 kilograms per square centimeter, and at 30° Centigrade at 9,390 kilograms per square centimeter. The transition is completed in a pressure range of about 1,300 kilograms at 0°, and about half this at 30°. A simple analogue of Clapeyron's equation governs the displacement of the transition. In NH_4Br the transition is displaced toward lower temperature by pressure, as would be expected from the opposite sign of the volume anomaly. At $-70°$ Centigrade the major part of the transition occurs at about 1,600 kilograms per square centimeter, and is very much more abrupt than

in the case of NH_4Cl. It will obviously require some modification in the simple picture of the mechanism hitherto described to account for the various differences in the behavior of NH_4Cl and NH_4Br.

Studies on electrokinetic potentials. IX. The electrical field of force at liquid-liquid interfaces: HENRY B BULL and ROSS AIKEN GORTNER (introduced by S. C. Lind). Apparatus was devised whereby the electrokinetic potential (the potential existing across the Helmholtz double layer) can be measured for an oil-aqueous solution interface using streaming potential technic. In its essential features the method consists of immersing two insulated platinum electrodes in a volume of oil and streaming a "rod" of water through a pin hole in one electrode so it passes through the oil and impinges upon the opposite electrode, imparting to it an electric charge. The difference in potential between the electrodes is then measured by means of a quadrant electrometer. The E.M.F. measured was found to be proportional to the hydrostatic pressure under which streaming was induced. The temperature coefficient of the potential was found to be appreciable. Potential curves were determined for the systems; refined paraffin oil (Nujol) and various concentrations of aqueous solutions of NaCl, $CaCl_2$, $ThCl_4$ and sodium stearate. Sodium stearate, sodium chloride and calcium chloride increased the electrokinetic potential at the interface in solutions of low concentrations, sodium stearate solutions being particularly effective. Higher concentrations reduced the potential somewhat. Thorium chloride solutions reduced the potential and reversed the charge from (−) to (+). The electrokinetic potential curves at oil-aqueous solution interfaces closely resemble electrokinetic potential curves at cellulose-aqueous solution interfaces or glass-aqueous solution interfaces. The measured potentials do not parallel interfacial tension changes.

Equilibrium theory of the cathode spot in mercury arcs: KARL T. COMPTON. The following considerations yield some definite information regarding the fraction of the current at the cathode of a mercury arc which is carried by electrons and show that the temperature of the cathode spot is so low that the electron emission can not possibly be of thermionic origin. The results therefore are in support of Langmuir's theory according to which the electron current from the cathode is a field current of electrons which are drawn out by the intense field concentrated there by the positive ion space charge. Four years ago Dr. Van Voorhis and the author presented to the academy a theory of the heat balance at the cathode. This theory is now extended by evaluating factors regarding which there was then insufficient knowledge. There are eight principal ways in which heat is fed into or taken away from the cathode. All these are now evaluated except for uncertainty in two quantities, one being the fraction of positive ions produced near the cathode which move, contrary to the applied voltage, toward the anode, and the other is the accommodation coefficient which measures the fraction of kinetic energy of a positive ion impinging on the cathode, which is delivered to the cathode. One equation which does not involve either of these unknown quantities gives a lower possible limit to the fraction of current carried by electrons. The other equation, which involves these two unknown quantities, gives an actual value for this fraction. Certain experimental evidence regarding these unknown quantities leads to the conclusion that the fraction of current carried by electrons at the cathode is certainly considerably in excess of 0.80. By applying equations of kinetic theory of gases to the observed rate of evaporation of mercury from the cathode spot, an equation relating vapor pressure to temperature at the surface of the cathode spot is obtained. By comparing this equation with the ordinary vapor pressure temperature relation for mercury vapor, unique values are found for the temperature of the cathode spot and the vapor pressure immediately outside it. These values depend on the value of the fraction of current carried by electrons, but the permissible values of this fraction show that the temperature of the cathode spot can not be higher than about 200° Centigrade. A consideration of the mechanism of ionization and of the pulling of electrons out of metals indicates that the ionization near the cathode must be of the cumulative type in which an atom is ionized by successive impacts of at least two electrons. These considerations enable us to plot a potential distribution curve for the region near the cathode which appears to be constant with all known facts regarding the mercury arc, although the distance scale on which this diagram is drawn can be fixed only between upper and lower limits. This theory appears to be equally applicable to the small mercury arc, such as that used for illumination and for the very large arcs now used in the metal tank rectifiers for electric railway operation.

Electron lenses: C. J. DAVISSON and C. J. CALBICK.

X-ray scattering by gases and atomic structure: E. O. WOLLAN and A. H. COMPTON. Measurements have been made of the intensity of the x-rays scattered at different angles by hydrogen, helium, oxygen, neon and argon. From these measurements the electron distributions in the atoms of helium, neon and argon have been found. For scattering by oxygen, neon and argon, a wavelength of $\lambda = 0.71$A, obtained by Ross' double filter method, was used. For hydrogen and helium it was necessary to use a single filter and an effective wavelength of 0.50A to get sufficient intensity. The scattering by the various gases was compared with that by hydrogen at 90 degrees, whose intensity can be reliably calculated. Electron distributions are calculated from these data for helium, neon and argon, using a straightforward application of Fourier integrals. The results can not be reconciled with Schrodinger's early interpretation of $\psi\psi^*$ as representing a continuous distribution of electricity, but are in excellent accord with the quantum mechanics predictions if $\psi\psi^*$ is interpreted as a probability of the occurrence of electrons.

Atom building in steps: W. D. HARKINS.

The rise of man and modern research: JAMES H. BREASTED.

Biographical memoir of John Fillmore Hayford (read by title): WILLIAM H. BURGER.

Biographical memoir of Stephen Alfred Forbes (read by title): L. O. HOWARD.

Biographical memoir of Ira Remsen (read by title): WILLIAM ALBERT NOYES and JAMES FLACK NORRIS.

Biographical memoir of Frank Austin Gooch (read by title): RALPH G. VAN NAME.

Biographical memoir of Thomas Burr Osborne (read by title): HUBERT BRADFORD VICKERY.

Biographical memoir of Robert Ridgway (read by title): ALEXANDER WETMORE.

Report of the National Academy Committee on the Grand Canyon project: JOHN C. MERRIAM.

Regarding definition of problems which concern evolution of man: JOHN C. MERRIAM.

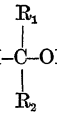
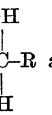
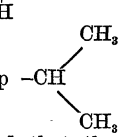
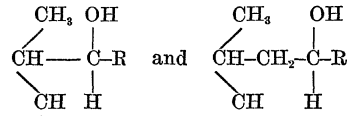
The discharge of hot springs in the Yellowstone Park: E. T. ALLEN. As a part of an investigation in the Yellowstone Park, carried on by a Geophysical Laboratory during the last six years, an attempt was made in 1930 to determine the aggregate discharge of water from the hot springs of this famous locality. The value obtained is regarded as a first approximation which may safely be compared with the volume of the cold drainages and with the measured discharge of other hot springs districts. In one important hot spring group, a long series of accurate measurements enables us to draw satisfactory conclusions regarding the constancy of the discharge. In another large basin the measurements, while fewer and less accurate, leave no doubt concerning the same question. The magnitude of the discharge in spring groups of different type is strikingly different. Inasmuch as the volume of the water is held to be a factor of first importance in the development of each type, this result has a special interest. From the values for the discharge and numerous analyses of the waters the magnitude of the dissolved mineral matter carried away by the water has been computed.

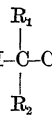
Fundamental scientific data resulting from geodetic surveys: WILLIAM BOWIE. The geodetic work of the Coast and Geodetic Survey has as its primary purpose the furnishing of geographic positions and elevations of thousands of points along the coasts and over the area of the interior of the United States as the bases for charts, maps, surveys, and many other engineering operations. The data resulting from these surveys are also of fundamental importance in science. It is by means of geodetic measurements of distances and angles and astronomical determinations of latitude and longitude that the figure of the earth can be determined. We know the figure of the earth, that is, its dimensions and shape, with a high degree of accuracy, but science is always striving for perfection. We have, in North America, connected geodetic surveys covering the United States and portions of Mexico and Canada, which will, in the near future, be used for a new determination of the earth's dimensions. The new value should have even greater strength than previous ones. By means of geodetic data, isostasy has been proved to be a scientific principle. According to this principle the irregular surface of the earth is due to varying densities in the crust below. Under the continents the material is less dense than it is under the oceans. The space within which these varying densities occur is limited by a level surface approximately 60 miles below sea level. The proof of isostasy leads to the definite conclusion that the interior of the earth is composed of material that is plastic to long-continued stresses. The geodetic data furnish a means by which varied structure, at least in its general outlines, can be discovered. This makes geodetic data of economic importance in searching for minerals. The accurate determination of geographic positions and elevations by geodetic methods enables one to test the stability of the earth's surface in any given region. The accuracy of the leveling, by which elevations are determined, is such that a closed loop of leveling has an error seldom greater than at the rate of 0.2 of a millimeter per kilometer of the distance around the circuit. In the triangulation, by which the geographic positions are determined, distances can be measured across country with an accuracy of one part in from two to four hundred thousand. It is readily seen that by repeating the observations from time to time the geodetic engineer can disclose any movements in position or elevation of the established stations. This method has been employed in California to detect what changes in geographic positions occurred at the triangulation stations near the San Andreas fault. This same method has been employed extensively in Japan to detect earth movements during earthquakes there. The observations made at the Variation of Latitude Stations at Ukiah, Calif., and Gaithersburg, Md., in connection with similar observations at stations in other countries, furnish data of fundamental importance to the science of astronomy. From the resulting data secured at these stations an estimate can be made of the rigidity of the earth. The triangulation and leveling of the United States are progressing rapidly. It is expected that the first and second order triangulation and leveling will be completed in the next twelve years. When this is done there will be few, if any, places in the country more than about 25 miles from a first or second order triangulation station or leveling bench mark. Intermediate areas will be covered by geodetic surveys of a lower order as the topographic mapping progresses. This expanded program of geodetic work of the U. S. Coast and Geodetic Survey is due to the initiative of President Hoover, who recommended to Congress that funds be provided for more rapid operations.

The physical basis of modern hydrographic surveying: A. L. SHALOWITZ (introduced by William Bowie). The

Great War was not only a landmark in the political and economic affairs of the world, but it marked, as well, the dawn of a new era in the application of the physical sciences to the problems of the hydrographic engineer. The possibility of utilizing sound as a means of measuring ocean depths and distances had been recognized long before this period, but no practical method had been evolved for meeting the exacting demands of modern hydrographic surveys. The investigations made during the war were quickly focussed on peace-time needs by the various maritime nations, resulting in this country in the development of the sonic depth finder by the U. S. Navy and later the fathometer by the Submarine Signal Corporation. With the development of sonic sounding came the Radio Acoustic Method of Position Finding, by means of which the positions of soundings are determined by measuring the time interval for a sound impulse to travel from the surveying vessel to two or more predetermined hydrophone stations near shore or at suitable points offshore. The application of acoustic principles to hydrographic surveying has been responsible for the rapid progress made by the Coast and Geodetic Survey, in the last few years, in the accurate and detailed charting of the waters along the Pacific Coast, and has made practicable the enormous Georges Bank undertaking. Through the instrumentality of the echo-sounding machine, an uncharted submarine valley, two miles wide, eight miles long and 1,800 feet deep, has been discovered on this bank, directly in the westbound transatlantic steamer lane and ideally oriented for vessels reshaping their course for Nantucket Light Ship. The paper discusses some of the problems entering into the acoustic method of surveying and shows the desirability and importance of knowing the path followed by the sound wave in its journey from the bomb to the hydrophone, particularly in an area where it is not feasible to determine the velocity of sound by direct methods. The paper presents the results of a study of the relationship between experimentally determined velocities of sound and theoretical velocities based on surface, mean and bottom temperatures of the water. The investigation indicates that the peak of the sound energy that reaches the hydrophone has been affected by physical conditions closely analogous to that obtaining at the bottom layers of water between the bomb and hydrophone. While the conclusions reached are by no means presented as a final product, this theory of sound-wave propagation, if substantiated by further experimental data, will have a far-reaching effect on future surveying operations and investigations.

The colloid chemistry of insanity: WILDER D. BANCROFT and G. HOLMES RICHTER. Insanity can be produced by suitable administration of peptizing agents or of coagulating agents. There are therefore two kinds of insanity, one in which the colloids of the brain are over-peptized and the other in which they are over-coagulated, insanity occurring when the brain colloids are far enough removed from the normal state. The coagulation form of insanity can be helped by treatment with dispersing agents, such as bromides or thiocyanates. The dispersion form of insanity can be helped by treatment with coagulating agents, such as cocaine or amytal. Probably caffeine would be still better.

Chemical structure and optical activity: P. A. LEVENE and R. E. MARKER. Previous observations of this laboratory have led to the conclusion that in simple substances of the type  the direction of the rotation is determined by the respective weights of the radicles R_1 and R_2. When in the arrangement of Fig. 1, $R_1 > R_2$ the substance is dextrorotatory. If R_1 is replaced by a polar group, as –COOH, then the latter group determines the direction of rotation and all substances of the type  are levorotatory. It was now found that the group  has an effect similar to a polar group and that the character of its effect is altered by the distance which separates it from the asymmetric carbon atom so that the members of the two configurationally related series of carbinols, *i.e.*,  rotate in opposite directions.

It has been found further that in the case of hydrocarbons of the type  the direction of the rotation is determined by the respective weights of the groups R_1 and R_2. The changes in the numerical values of the rotations of individual members have been found to vary according to the rule of the "asymmetry product" enunciated by Guye so that in homologous series of hydrocarbons the direction and the numerical values of the rotation are predictable. In the case of hydrocarbons the effects of the isopropyl and of the isobutyl groups are analogous to those in the case of the carbinols. In a general way the conclusion has been reached that the rotation of a given substance is determined in the simplest case by the distribution of masses around the asymmetric carbon atom. In the more complicated cases when a polar group enters into the structure of a molecule the rotation is determined (1) by the respective weights of the masses surrounding the asymmetric carbon atom; (2) by the effect of the polar group, and (3) by the distance of the polar group from the asymmetric carbon atom.

The heat of combustion of methyl alcohol: FREDERICK D. ROSSINI (introduced by George K. Burgess). Be-

cause of its importance in the study of the equilibrium conditions of the reaction involving the synthesis of methyl alcohol from carbon monoxide and hydrogen, and because of the discordant nature of the existing data, the heat of combustion of methyl alcohol has been measured. In the present investigation methyl alcohol was burned at constant pressure in a reaction vessel in the calorimeter, and the thermal effect produced by the reaction was duplicated as nearly as possible with electrical energy. For the heat evolved in the reaction, $CH_3OH(g) + 3/2\ O_2(g) = CO_2(g) + 2H_2O(l)$, at 25° C. and a constant pressure of 1 atmosphere, the data of 9 experiments give the value of 763.77 ± 0.20 int. kilojoules per mole. Combining these data with those of Fiock, Ginnings and Holton on the heat of vaporization of methyl alcohol, gives, for the heat evolved in the reaction $CH_3OH(l) + 3/2\ O_2(g) = CO_2(g) + 2H_2O(l)$, the value 726.34 ± 0.20 int. kilojoules per mole at 25° C., 1 atmosphere. With the factor $\frac{1.0004}{4.185}$ these heat values are respectively 182.58 ± 0.05 and 173.63 ± 0.05 kg-cal_{15} per mole. The value given by Richards and Davis is 1.5 per cent. lower than the present one, while the recomputed data of Thomsen give a value in agreement with it, within the assigned limits of error.

Form factors in types of fish skulls: WILLIAM KING GREGORY. The study of over 200 different types of fish skulls leads the author to the conclusion that there is undoubtedly a regulating influence that adjusts the size and proportions of the head to those of the body as a whole in such a way that a stream-line normally results. The skull is subjected primarily to the growth forces that mould the body as a whole and these general growth forces affect the individual bones that lie in their paths; but the parts of the head themselves also have a degree of influence on the form of the skull; as each pair of main sense organs becomes enlarged or reduced, the corresponding parts of the skull change with them. The changing characters of the jaws and branchial arches have had profound effects upon the form of the braincase and the changing positions of the mouth in different types of fishes have had a great effect upon the jaw bones and the skull.

Contributions to North American herpetology; the frogs: ALBERT HAZEN WRIGHT and ANNA ALLEN WRIGHT (introduced by Leonhard Stejneger).

A new application of metaxenia through differential pollination: W. T. SWINGLE (introduced by R. A. Harper).

The character and inheritance of developmental differences in fruit shape: EDMUND W. SINNOTT (introduced by C. E. Allen). It has been shown that fruit shape in various plants is determined by genetic factors which are inherited independently of those governing volume or dimensions. These shape factors presumably control growth correlations. Their character and method of inheritance have thus far been studied chiefly by an analysis of differences in the shape of mature fruits. An investigation of fruit development, however, from ovary primordium to maturity, shows that there are marked differences in the manner by which fruit shape may be attained. Various pure lines, differing in fruit shape, were studied in *Cucurbita Pepo* and *Capsicum annuum*. In Cucurbita the shape index of the mature fruit is in most cases not widely different from that of its ovarial primordium, but in certain lines the fruit becomes progressively somewhat flatter as it develops. If shape index is plotted against volume, various inbred lines manifest marked and specific differences in the character of the curve produced. This may be essentially a straight line, differing only in pitch in different races; or it may show distinct concavities, the character and depth of which are also highly specific. In general, the slope of this curve is steeper in races which have a relatively "flat" fruit shape. Certain lines, between which the major shape difference is due to a single genetic factor and which are also clearly different in the slope of their developmental curves, were crossed. It was found that the F_1, whatever its shape index, was usually intermediate in the slope of its curve, and that the members of each of the two segregating shape types in the F_2 showed a considerable variability in the slopes of their developmental curves. Other lines, essentially similar both in shape index and in development, differ markedly in the ability to transmit their specific developmental characters to their progeny in crosses with other lines. Crosses between two lines each showing relatively flat developmental curves may produce offspring with markedly steeper ones. Capsicum differs from Cucurbita in that the ovarial primordia in all types are very similar. The growth of the flat, the isodiametric and the elongate fruit types from these primordia involves profound developmental differences. An understanding of the manner in which genetic factors determine fruit shape must evidently depend upon a study not only of the mature structure itself but also of the changes undergone during its developmental history.

Stimulation by alcohol: W. J. V. OSTERHOUT and S. E. HILL. Alcohol is able to produce electrical changes in plant cells and hence to start and stop action currents: it therefore acts as a stimulus and as a block.

The effects of deprivation of manganese on the rat:[1] E. V. MCCOLLUM and ELSA R. ORENT. Rats restricted to a diet which is essentially free from manganese grow normally. They begin to produce litters at the normal age. The young are born alive. The mothers do not build a nest or collect their young or hover over them, and the stomachs of day-old young never contain any milk, and the young die from neglect. Vaginal smears show that the adult females go through the normal estrual cycle and if kept with normal males their fertility approximates that of normally fed rats. These mothers with one exception declined to nurse their own young and did not care for foster young from the stock colony.

[1] From the Department of Chemical Hygiene of the School of Hygiene and Public Health of the Johns Hopkins University, Baltimore, Maryland.

In tests with about one hundred young from manganese-free mothers only one animal was reared by stock females which had just delivered litters, whereas exchanging young of stock mothers does not result in lack of maternal solicitude. It appears that the normal mother detects something wrong with the young of manganese-free mothers and abandons them. This happens even when the young of manganese-free mothers are wrapped in cotton with normal stock litters of new-born for an hour or more for the purpose of putting the odor of each kind of young on the other before placing them with the stock mothers. Histological studies are being made of the mammary tissue at different stages of gestation, to determine whether there is any development preparatory to milk secretion. The addition to the manganese-free diet of as little as five thousandth of one per cent. of manganese results in preventing the behavior of the female rats toward their young. With this addition they care for their young normally and have almost no infant mortality. Male rats kept on a manganese-free diet show no abnormality other than testicular degeneration. This degeneration is well under way by the hundredth day on the diet. The atrophy then rapidly proceeds until only vestiges remain and complete sterility results. The histological changes at different stages of degeneration of the testes will be described later. There is little or no tendency to obesity in these males. The testicular atrophy and the failure of females to suckle young suggest failure of some hormone production in the hypophysis. There is a clinical literature on male sterility developing in middle life, which is referred to hypophyseal deficiency. There is likewise recognized by endocrinologists a stimulating effect on milk secretion caused by the administration of certain hypophyseal extracts. Observations thus far made seem best explained on the theory that manganese is in some manner related to hormone formation by the hypophysis. The problem is being studied in detail.

New methods for locating genes in particular chromosomes: ALBERT F. BLAKESLEE. The usual method of locating genes is by linkage between two or more genes in disomic inheritance. The newer methods developed in Datura include the following: (1) All the 12 primary (2n + 1) types when heterozygous for a given gene throw disomic ratios in their offspring except the type whose extra chromosome carries the locus for this gene. This latter primary throws trisomic ratios. By trisomic ratios from (2n + 2/2) secondary types, from (2n + 1) tertiary types with a compound chromosome extra, and from extra fragment types, genes may be located in particular parts of chromosomes. (2) Compensating types, in which parts of two chromosomes compensate to form the equivalent in genic content of a whole chromosome, if heterozygous for a gene with its locus in the compensated chromosome will breed true for this gene among its 2n offspring, except for crossing over. Double compensating types are known which compensate for two different chromosomes. (3) Types with a translocated fragment, which enables the plants affected to be recognized by external characters, if heterozygous for a gene with its locus in the chromosome to which the fragment is translocated, will breed true for this gene among its 2n offspring, except for crossing over. (4) Prime types (types with chromosomes modified by segmental interchange) if they induce a definite proportion of aborted pollen in the heterozygous condition may be used to locate genes by ratios of individuals in the offspring with good to those with characteristic percentages of aborted pollen. This method locates the gene in one of two chromosomes if the prime type has two chromosomes modified. (5) If a plant heterozygous for a gene which causes abortion of one half the pollen grains but which does not affect the vitality of the egg cells is rendered heterozygous for a non-lethal gene, all the offspring from the male back-cross will be homozygous for the gene, except for crossing over. In the usual method of locating genes by linkage, the crossing-over values are determined by the interaction of two genes with loci in the some chromosome. By the methods 1, 2, 3 and 4, here given, the crossing over of a given gene can be determined without regard to the behavior of a second gene.

A new travertine-forming organism: MARSHALL A. HOWE. The geological importance of certain aquatic plants known in a general way as the algae has received increasing recognition during the past twenty-five years. Not only have certain so-called "coral" reefs been found to have been built up by lime-secreting plants rather than by lime-secreting animals, but many fresh-water deposits of lime, both recent and fossil, have been found to be due chiefly to the peculiar activity of minute plants belonging to the group known as the blue-green algae. The speaker described in particular a very minute lime-precipitating organism of bacterial dimensions that is responsible for the formation of concentrically layered pebbles and sometimes more extensive deposits of limestone that occur in "hard-water" streams of Pennsylvania and West Virginia. This organism, geologically important, is believed to be new to science.

(To be continued)

BOOKS RECEIVED

BLANCHARD, W. O., and S. S. VISHER. *Economic Geography of Europe.* Pp. ix + 507. 331 figures. McGraw-Hill. $3.50.

CHAMOT, ÉMILE M., and CLYDE W. MASON. *Handbook of Chemical Microscopy.* Volume II, Chemical Methods and Inorganic Qualitative Analysis. Pp. ix + 411. 181 figures. Wiley, $4.50.

HACKH, INGO W. D. *Structure Symbols of Organic Compounds.* Pp. viii + 139. 29 plates. Blakiston.

MEIER, W. H. D., and LOIS. *Essentials of Biology.* Pp. vii + 529. 332 figures. Ginn. $1.68.

MILLER, EDWIN C. *Plant Physiology.* Pp. xxiv + 900. 38 figures. McGraw-Hill. $7.00.

SIMONSEN, J. L. *The Terpenes.* Volume I, The Simpler Acyclic and Monocyclic Terpenes and their Derivatives. Pp. xv + 420. Cambridge University Press, Macmillan. $8.50.

SMALLWOOD, JULIAN C., and FREDERIC W. KEATOR. *Mechanical Laboratory Methods.* Fourth edition. Pp. xii + 386. 121 figures. Van Nostrand. $3.50.

STRECKER, EDWARD A., and FRANKLIN G. EBAUGH. *Practical Clinical Psychiatry for Students and Practitioners.* Third edition, revised. Pp. xvii + 553. 47 illustrations. Blakiston.