of the wild forms were apparently more or less dominant to their respective allelomorphs of the cultivated varieties with respect to some characters. Skewed and multimodal effects were manifested by some frequency distributions. Paris White Cos was the only cultivated variety which gave evidence of having any quantitative characters dominant to those of the wild lettuce. F_3 and F_4 generations gave further evidence of segregation. In practically all crosses it was found possible to establish new types, of comparatively low variability, in F_3 and F_4, with higher or lower mean values, or both, than those of the parent varieties.

The wild forms of lettuce gave evidence of being more heterozygous for some quantitative characters than the cultivated varieties. This difference is believed to be due to the effect of artificial selection in promoting the development of fairly homozygous cultivated varieties, while in the wild forms there has been no restraint, other than that of natural selection, to the perpetuation of mutations which have probably occurred with respect to quantitative characters.

The investigation indicates that the growth of lettuce is highly susceptible to environmental influences.

Cultivated varieties apparently possess genetic combinations which respond more favorably to moist weather conditions than those of the wild forms.

The results of this and other investigations indicate that in many cases modified and deviating Mendelian ratios may be the result of linkage of quantitative genes with genes affecting fertility or sterility which are highly responsive to variations in environment.

Castle's proposed method for estimating the number of pairs of genes involved in quantitative inheritance is not adapted for the purpose so far as lettuce is concerned, and it is believed to be inadequate in practically all cases of quantitative inheritance.

The results indicate that cultivated lettuce probably developed from the wild *Lactuca scariola*. The differences can be accounted for very largely, if not entirely, by the appearance of mutations in dominant genes, coupled with the cumulative effects of artificial selection in perpetuating modifications which have served the purposes of man.

The method of nomenclature originally proposed for cultivated lettuce by Linnaeus and recently revived by Bailey (1924) is supported by the results of this investigation.

This preliminary report is made in order that the more important results of the investigation may be placed on record. A more detailed account of the experiments will be published at a later date.

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THE NATIONAL ACADEMY OF SCIENCES. III

A Pleistocene avifauna from Florida (illustrated): A. WETMORE (introduced by David White).

Mountain building in Fenno-Scandia and pre-Cambrian correlation: J. J. SEDERHOLM (by invitation). In Fenno-Scandia several different epochs of mountain building can be distinguished. The mountain chains of different age intersect each other and show no parallelism in their strikes. Thus at the Arctic coast three mountain chains of different ages, directions and character occur near to each other. In the "Karelides" of eastern Finland, old mountain chains with a prevalent north-northwesterly strike, the intensity of the diastrophism varies greatly in different zones. In some areas the rocks are slightly disturbed and feebly metamorphic; in others they are strongly folded, highly metamorphic and intimately injected with granitic veins, thus presenting the character which is common in the Archean. The character of the disturbances has been, as lately shown by Wegmann, very similar to those which have taken place in the Alps. There have existed simultaneously more or less resistant areas, and the folding has not been uniform or ubiquitous. The author thinks that there is in general no certain evidence of a ubiquitous folding in pre-Cambrian time. Much of the correlation of pre-Cambrian series in different parts of the world has been based on that wrong presumption and must therefore be revised. Rocks which show a "Proterozoic" type in some parts of the world may be expected to be extremely crystalline and intimately injected by granite in another, and a correlation based on the relation of the sedimentary deposits to epochs of diastrophism will be possible only if we are able to show which are really synchronous. Analogies in the character of sediments, caused by climatological differences, world-wide epochs of volcanism, etc., may give further criteria to their correlation. Only by a detailed comparative study of pre-Cambrian rocks in different parts of the world will it be possible to work out their correlation and succession. In Fenno-Scandia alone, at least three or four great cycles of pre-Cambrian sedimentation exist, separated by periods of diastrophism and base leveling. The length of pre-Cambrian time, as measured by the sedimentary record, must be longer than that of all post-Cambrian time.

The rock suites of the Pacific and the Atlantic Ocean basins: HENRY S. WASHINGTON. At each of various regions of the earth the igneous rocks of a given region resemble each other (in mineral and chemical characters), so that one region may be very different from, or may be very like to, other regions, so far as its rocks go. Such regions of related rocks are called petrographic provinces. The petrographic provinces on the largest scale are the various continents and the floors of the various ocean basins. All the continents are made up for the most part of granitic rocks, while the ocean floors are composed largely of basalts, which are very different in many respects from granites. We can judge of the kind of material that forms the ocean floors by the lavas that

have come up from below and that have formed the volcanic islands in the oceans. From many studies made in recent years we are sure that, while heavy basaltic rocks compose in great measure the floors of both the Pacific and Atlantic Oceans, yet there are all over in both oceans small quantities of very different kinds of lavas that contain much soda and potash, of which the basalts contain but little. Furthermore, the rocks of the Pacific and Atlantic islands, although they are much alike in general, show marked differences in some details, so that they do not appear to belong to the same petrographic province. It is thought by many that these differences are connected with the different ways by which the borders of the two ocean basins have been formed. The Pacific basin is surrounded by long mountain chains that have arisen by lateral pressure, while the borders of the Atlantic basin have been formed mostly by vertical sinkings and risings of great blocks of the earth's crust. It is suggested here that the differences between the rocks of the continents and those of the ocean floors, as well as those between the floors of the various ocean basins, have been little influenced by such movements of the crust, but that they may differ because the upper part of the original molten globe was not uniform all over, but varied in composition over large areas, before the crust was formed.

Bioelectrical phenomena: W. J. V. OSTERHOUT. Waves of negativity, similar in magnitude and form to those observed in muscle and nerve, may be produced in *Nitella* by a variety of chemical and physical agents. They may also occur spontaneously and are often rhythmic in character.

Some significant properties of the virus of typical tobacco mosaic: B. M. DUGGAR. Temperature relations of the mosaic virus have been determined by a new method eliminating the usual lag in temperature effects. Determinations of the relation to acetone, alcohol and other chemical agents as well as to solutions of high concentration seem to denote an agency with a stability above that of the bacterial vegetative cell, but distinctly more sensitive than the typical spore of bacteria. Adsorption and oxidation studies confirm previous reports of the colloidal properties of the virus, while resistance to enzymic action is a property of special significance.

Chemical aspects of disease resistance in the onion: J. C. WALKER, K. P. LINK and H. R. ANGELL (introduced by L. R. Jones). Resistance in the onion to the smudge disease caused by the fungus *Colletotrichum circinans* (Berk.) Vogl. is closely associated with the occurrence of pigments in the bulb scales. This resistance is caused by one or more readily diffusible substances present only in the pigmented scales. Drops of liquid from the scales containing these diffusible substances are toxic to the fungus, preventing normal germination and growth of the spores and mycelium. Invasion by the fungus is therefore less common in the pigmented bulbs than in the white bulbs. The chemical study of the water soluble substances from the pigmented scales has shown that one of the toxic entities is the phenolic acid, commonly known as protocatechuic acid. This acid has been isolated in a pure crystalline condition from the pigmented scales by a procedure that firmly indicates that the acid exists in the free state (*Jour. Biol. Chemistry*, 81: 369. 1929). The purified protocatechuic acid in dilutions of 1 part to 3,000 parts of water exhibits the characteristic toxic effects on the fungus organism that had previously been ascribed to the crude water extracts attainable directly from the pigmented scales. Protocatechuic acid appears to be one of the chief constituents responsible for the marked resistance exhibited by the pigmented onion to the smudge disease. To our knowledge this is the first time that disease resistance in plants has been attributed to a definite chemical entity present in the resistant host (the pigmented onions) and absent in the non-resistant host (the white onions).

The Opalinidae and their significance: MAYNARD M. METCALF (introduced by Lorande L. Woodruff). The things emphasized in this paper are: (1) the intermediate character of the Opalinidae, especially in nuclear conditions, between the Flagellata and the Euciliata; (2) the broad significance of data from parasites, when studied in connection with their hosts, especially as to geographical distribution, and (3) the need of further study of a number of features in the Opalinidae.

The macronucleus of Uroleptus Halseyi: GARY N. CALKINS. The macronucleus of *U. Halseyi* arises as a product of the second division of the zygote nucleus after conjugation. The Feulgen nucleal reaction shows no chromatin at the outset. After twenty-four hours small granules appear in the matrix of plastin (?). These increase in size and become demonstrable by the Feulgen method. Ultimately they fill the nucleus as minute rods of chromatin which stain intensely with nuclear dyes. They originate and grow evidently by the slow accumulation of nucleic acid. The nucleus now divides repeatedly until the definitive number is formed. When four are thus formed, the cell divides, the remainder being formed by nuclear division after the daughter cells separate. Prior to the next division of the cell each macronucleus forms a nuclear cleft (Kernspalt). This results as an effect of the action of granules (x-granules) in the nucleus which collect at a certain zone near one end. These granules are not chromatin but apparently act as catalytic agents which cause one end of each nucleus to be cut off. This end and the x-granules are cast off into the cytoplasm where they disappear. The remainder of each nucleus fuses with its fellows to form again a single division nucleus as at the outset. During conjugation the macronuclei gradually fade away and disappear in the cytoplasm. In their final condition they are each resolved into an aggregate of minute vesicles. Densely staining cortical material collects or is precipitated on the surface of these vesicles. This cortical substance breaks up into minute rods or crescents which disappear upon treatment with ether, acids or ultra-violet rays, and which give characteristic reactions with osmic and the usual chondriosome methods. These granules are undoubtedly the same as those which have been generally described as the protozoan mitochondria.

Biographical memoir of Edward Drinker Cope: H. F. OSBORN.

Biographical memoir of Henry Andrews Bumstead: LEIGH PAGE.

Biographical memoir of Henry Larcon Abbot: C. G. ABBOT.

Biographical memoir of Sidney Irving Smith: WESLEY R. COE.

Biographical memoir of Addison Emery Verrill: WESLEY R. COE.

The rôle of research in the development of forestry in North America: I. W. BAILEY and H. A. SPOEHR (introduced by John C. Merriam).

The Manobos of Mindanao: JOHN M. GARVAN (introduced by Raymond Pearl).

Approximation and correction as a general behavior pattern: RAYMOND DODGE. An important contribution to the formulation of behavior patterns was made by Thorndike, Lloyd Morgan and Jennings in the concept of trial and error, or better, trial and selection. While the concept applied primarily to infra-human responses to new situations it has also been useful in the description of human behavior. If one includes thought adjustments many of our human reactions in the practical conduct of life, in the earlier stages of invention and in scientific exploration seem to follow a pattern that reaches well back in the phylogenetic series. There is some evidence that in slightly more advanced stages of adjustment development of reaction proceeds not by the selection of a more appropriate mode of reaction but by the correction of approximations within the same general mode. Records of human eye movements following an object in harmonic motion, fixating a peripheral object and fixating a foveal object lead to the following generalization: Approximation and correction is a type of adjustment that appears in relatively simple forms of human behavior. We conjecture that it ranks with trial and selection as a general formula of adjustment. While the beginning of response to new situations commonly follows the trial and selection pattern, subsequent adjustment within any selected mode of response commonly follows the pattern of approximation and correction. The latter seems to be a complement of the former.

Pyrogenetic decomposition of the acid amides: EDWARD C. FRANKLIN.

The structure of thymonucleic acid: P. A. LEVENE and E. S. LONDON. The plant nucleic acid is regarded as a tetranucleotide, each nucleotide being composed of phosphoric acid, a sugar (ribose) and a nitrogenous component. The evidence for this theory of structure is complete, inasmuch as it was possible to decompose the nucleic acid into the individual nucleotides, and each of the nucleotides into phosphoric acid and the complex consisting of the sugar and a base. For the thymonucleic acid an analogous structure was suggested. The evidence, however, was incomplete, since it was impossible to decompose by chemical means the thymonucleic acid in such a manner as to obtain the complexes consisting of the sugar and bases. Such complexes are known by the name "nucleosides." By means of intestinal juice, it was now possible to hydrolyze the thymonucleic acid in a way which made possible the isolation of the four nucleosides present in the molecule of the acid. The nucleosides then made it possible to isolate the sugar component of the thymonucleic acid. Contrary to expectation, the sugar is not a hexose but a desoxypentose.

Crystalline turanose: C. S. HUDSON and EUGEN PACSU. The trisaccharide melezitose can be hydrolyzed by weak acids to yield glucose and a disaccharide which was named turanose by its discoverer Alekhine. Turanose has in turn been hydrolyzed by G. Tanret, using stronger acids, to glucose and fructose. Turanose has never been obtained fully pure in the past because no one has succeeded in crystallizing it. In 1918 one of the authors (C. S. H.) found an abundant supply of the rare melezitose in a certain kind of honey and from it he prepared a small quantity of turanose in the hope of crystallizing it. Other samples of turanose sirup were prepared subsequently from this same stock of melezitose by other workers. Recently it was observed that one of these sirups, the exact history of which is not now known, had crystallized after standing for many years. By the use of these crystals to nucleate turanose sirups which we have lately prepared from melezitose it has been possible to obtain a rapid crystallization of turanose and the sugar has been recrystallized with ease from hot methyl alcohol in which it is moderately soluble. Crystalline turanose on solution in water shows a large and rapid mutarotation. At 20° the rotation of its freshly prepared aqueous solution three minutes after dissolving was approximately $[\alpha]^{20}_{D} = +43.5$ and the value became constant within twenty minutes at about $[\alpha]^{20}_{D} = +75.6$. Crystalline turanose is thus a beta form of the sugar. The crystals are well-formed prisms with many faces developed. The sugar possesses a sweet flavor. Its melting point is 157°. A study of this interesting disaccharide, which can now be obtained in pure condition, has been undertaken.

Transformation of lactose to a new disaccharide, lactoketose: EDNA MONTGOMERY and C. S. HUDSON. The authors have sought to use the Lobry de Bruyn interconversion of sugars in alkaline solution as a general preparative method for the production of new ketoses from aldoses. In weakly alkaline lime water lactose rapidly changes in part to a new sugar which has been isolated in pure crystalline condition and named lactoketose. Its hydrolysis by acids yields a mixture of galactose and fructose. Its osazone is identical with lactose osazone and hence the new sugar is a galactosido-fructose disaccharide, a new ketose. As would be expected from its ketonic character, lactoketose is not oxidized by iodine in alkaline solution.