WHELDAL, Miss M. (1909): On the nature of anthocyanin. — Proc. Cambridge Phil. Soc., 15 pp. 137—168.

— (1910): Plant oxidases and the chemical inter-relationships of color-varieties. — Progressus Rei Botanicae, 3 pp. 457—474.

Explanation of Plate VI.

Plate VI. Reproduction of colored paintings of buds of *Oenothera rubrinervis*, natural size, to show the range of color variations. These were used as the types of classes in cataloguing the buds examined. They are accurate representations of particular individual buds. The individual differences are described in the text. Fig. 8 is a bud of *O. rubricalyx*, having red instead of green hypanthium and red median longitudinal ridges.

Referate.

Emerson, R. A. Factors for Mottling in Beans. American Breeders' Association 5 1909, pp. 368—376.

— Inheritance of color in the seeds of the common bean, *Phaseolus vulgaris*. Twenty-second annual Report, Nebraska Agricultural Experiment Station 1909, pp. 67—101.

The author summarizes the results of studies by Tschermak, Shull, and Emerson on the inheritance of color-characters in beans, with special reference to mottling (Marmorierung), and discusses two hypotheses proposed respectively by Shull and Spillman to account for the facts presented. The facts to be accounted for are briefly as follows:

There are two types of mottled beans, in one of which the mottling exists as a normal Mendelian unit-character epistatic to its absence, and which may be latent by separation in white races. The latency of this type of mottling has been definitely demonstrated by Emerson in the case of two varieties of white beans, "Davis Wax" and "White Marrow Field". This type of mottling may characterize pure races, as exemplified by the many common varieties of mottled beans. The other type of mottling does not appear in any pure race, but is produced as a novelty (Kreuzungsnovum) by crossing certain self-colored races with certain other self-colored races or with certain white races. In this case mottling appears in all F_1 individuals, but in the F_2 , mottled and self-colored individuals are always present in approximately equal numbers, giving rise to ratios 1:1 and 3:3:2, instead of 3:1 and 9:3:4. In F_3 and subsequent generations these ratios 1:1 and 3:3:2 are repeated in the progenies of every mottled bean, none of them producing only mottled offspring.

Tschermak explained the mottled beans of this second type as new "eversporting half-races" produced by mutation as a result of hybridization (Hybrid-mutation). Shull referred them to a definite gene for mottling which he assumed to be capable of manifesting itself only when in the

heterozygous state. In the first paper mentioned above Emerson tentatively accepts Shull's hypothesis and expresses the view that the two types of mottling in beans are entirely unrelated to each other, being due to the existence of two distinct and independent mottling units, which he calls **M** and **X**. Upon this assumption he works out the various possible hybrid combinations among beans possessing these factors and shows that certain crosses of mottled with self-colored (e. g. **PPMMxx** $\times$ **PPmmXX**) should produce in the F_2 , mottled and self-colored beans in the ratio 7:1, or 11:5, and that certain crosses between mottled and white (e. g. **PPMMxx** $\times$ **ppmmXX** and **PPmmXX** $\times$ **ppMMxx**) should yield mottled, self-colored and white in the ratio 21:3:8 or 33:15:16, the first ratio in each pair being produced if **M** is epistatic to **X** and the second if **M** is hypostatic to **X**. The critical crosses necessary to demonstrate these ratios have not yet been made.

In the second paper the author reviews this discussion of the relation of the two types of mottling, and presents a third explanation which has advantages over the hypotheses of Shull and Emerson. This third hypothesis, proposed in correspondence by Dr. Spillman, assumes that there are not two distinct and independent genes determining the two types of mottling, but that there are two factors which act together to produce the mottling, and that these factors are coupled in the permanently mottled races. Spillman considers these two factors to be distinct functions, **Y** and **Z**, of the same morphological organ in the cell, presumably a chromosome, or a part of a chromosome. Any homozygous plant having a chromosome with both of these functions, **Y** and **Z**, will be a permanently mottled race. Either one or both of these functions may be lost, thus giving rise to three different non-mottled races, one having a pair of chromosomes with the function **Y**, another having the corresponding pair of chromosomes with the function **Z**, and the third having the corresponding chromosomes with neither the function **Y** nor **Z**. Whenever two of these defect-races are crossed together, one of which has the function **Y** the other the function **Z**, the result will be a mottled F_1 hybrid, and as these two functions, **Y** and **Z**, belong to corresponding chromosomes, they will display "spurious allelomorphism", being separated into different germcells, so that only the heterozygote of the second and succeeding generations will again have associated together the two factors necessary for mottling. Both the Shull-Emerson hypothesis and the Spillman hypothesis fit all the facts known, and it will doubtless be entirely impossible to demonstrate the truth of one and the falsity of the other, but Spillman's hypothesis has the advantage that it does not require a character to be visible when inherited from only one parent, but invisible when inherited from both parents, this being the fundamental difficulty with Shull's hypothesis.

In the second paper, Emerson gives evidence indicating that hypostatic colors which are entirely invisible in self-colored beans, may become visible as underlying colors in mottled beans, and consequently that crosses in which both mottled and self-colored beans are produced, there may be a larger number of mottled phenotypes than of self-colored phenotypes, tho the number of genotypes of the mottled and self-colored classes are equal. This is due to the fact that the hypostatic colors in the mottled beans do not occupy the same areas as the epistatic colors, thus allowing the former to be partially uncovered by the latter. Each hypostatic color as well as each epistatic color may thus determine a class of mottled beans, while only the epistatic colors can be used in grouping the self-colored beans.

A most interesting relation between color hypostasis and albinism is pointed out. It is shown that whenever two pigmented races are crossed, which have no color modifier in common, albinism must appear in a certain proportion of the offspring, the proportion depending on the number of color-factors present. Thus if **B**, **D** and **R** be each capable of producing pigmentation, the cross between two pigmented beans, BBddRR and bbDDrr, will produce one albino, bbddrr, in sixty-four F_2 offspring, tho neither of the parent-strains has ever been previously crossed with white. If the parents differed in regard to four color-factors, none of which were possessed in common, there would be one white in 256 individuals, and so on. Crossing a white bean produced in this manner with another white bean which lacks chromogen but possesses a pigment-modifier, would result in a progeny of pigmented beans, in the same manner that crossing two white sweet peas produces colored offspring, but no such result has yet been gained by crossing beans.

It is also shown that the 3 to 1 ratio should be expected in the F_2 of a cross between pigmented and white beans only (a) in case the white bean lacks pigment and has at least one modifier in common with the pigmented bean with which it is crossed, or (b) in case the white parent has chromogen but lacks all pigment-modifiers and the pigmented bean with which it is crossed has only one pigment-modifier. In any other case the ratios will range from 2.4:1 to nearly 3:1, depending on the total number of pigment-modifiers involved. This may account for an excess of white beans beyond the 25 per cent expected in certain crosses.

Geo. H. Shull.

Hase, Albrecht. Über die deutschen Süßwasserpolyphen *Hydra fusca* L., *Hydra grisea* L. und *Hydra viridis* L. Eine biologische Vorarbeit, zugleich ein Beitrag zur Vererbungslehre. Arch. f. Rassen- u. Gesellschafts-Biologie. 6. Jahrg. 6. Heft. 1909. S. 721—753.

Untersuchungen über das Lebensalter der Süßwasserpolyphen ergaben, daß *H. grisea* mit einer durchschnittlichen Lebensdauer von 95 Tagen älter wird als *H. fusca* mit rund 35 Tagen. Dementsprechend kommt der ersteren ein kleinerer Vermehrungsfaktor für den Tag zu. Allerdings schwankt bei jeder Art die Fruchtbarkeit individuell.

Die Tentakelzahlen erwiesen sich als reine nicht erbliche Somationen, die mit dem Alter zunehmen; während die im höheren Alter abgeschnürten Knospen nicht die Tentakelzahl der Mutter besitzen, sondern eine geringere, der Grundzahl der Spezies angenäherte.

Hanel hat also mit Unrecht ihre nach der Tentakelzahl charakterisierten Linien mit den reinen Linien Johannsens gleichgestellt, denn bei den letzteren handelt es sich um ein für Eltern und Nachkommen konstantes Merkmal.

Hilzheimer-Stuttgart.

EAST, E. M. The transmission of variations in the Potato in asexual reproduction. Connecticut Agr. Expt. Station Report. 1910. S. 119—160. plates 5.

This paper shows the similarity between the inheritance of fluctuations in asexual reproduction in multicellular organisms, and that in the pure lines of Johannsen and Jennings. It is found that neither the relative content of dry matter nor that of the nitrogenous matters of the tuber can be