nomena in the unstable static conditions of the outer layers of the sun.

I am not aware that such a suggestion as this has ever been made to account for Sporer's law. Of course I see many objections to it. The improbability of such waves long retaining their shape, and the observed absence of sun spots in the north hemisphere from 1672 to 1704, suggest themselves as obstacles.

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AFRICAN BASKETRY WEAVES

A large collection of ethnological specimens recently received by the Museum of Natural History, New York city, contains a selected series of baskets from the Barotse and Bechuana tribes. These baskets compare favorably in technique and finish with those of California and, what is of special interest, present all the typical weaves known in America. Among the Barotse baskets alone we find the following kinds of woven basketry: wicker, checker, twill, wrapped, plain twine, open twine, twilled twine, and the California 'ti.' Also in coiled basketry, one rod coil, grass coil closely covered, also with foundation showing bifurcated coil closely covered, also with only lines of stitching and coil without foundation.

The more elaborate manipulation of warp elements or materials in general, seems not to be practised, for there are neither cross-warp checkers nor cross-warp twines in the collection. The edges, while of all types, represent rather the refined variations. The thought of solidity or stability seems to have been the main idea. This is particularly well illustrated in the large rope coil and one-rod foundation coil chests and storage baskets. The technic is perfect and with the close-fitting lids give exceptional protection to grain or other contents. Strengthening by bands of the 'ti' weave, a technic heretofore thought to be limited to the Pomo Indians of California, is found; also an unusual wrapped twine, with the horizontal warp on the outside, like some Aleutian burden baskets.

The decorations in color occur chiefly in coil baskets. The color of the designs is uniformly black.

The main point of interest is that within a definite ethnic area of South Central Africa an aboriginal people practise basketry in which are found practically all of the typical weaves known to the world.

Mary Lois Kissell

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THE RECUPERATIVE POWER OF ITALIAN AND ENGLISH WORKMEN

To the Editor of Science: I am afraid that the statements contained in the letter of Mr. Joseph Y. Bergen,[1] as to the recuperative power of Italian and English workmen may induce some readers to unwarranted generalizations.

A statement of the kind would have more value if a comparison were made between the diet and the conditions of people of the *same race* and the same locality, provided in each case there existed a sufficiency of the articles of diet.

On the other hand, it is a known fact, that, generally speaking, the rural population of Europe has better recuperative powers than the inhabitants of the cities, although the latter eat much meat, while the country people live almost exclusively on a vegetable diet, meat being considered too expensive.

L. H. Baekeland

SPECIAL ARTICLES

SOME LATENT CHARACTERS OF A WHITE BEAN[2]

In order to secure material to display as simple illustrations of Mendel's laws of dominance and gametic purity, I made reciprocal crosses last year (1904) among four different varieties of the common bush bean. These varieties were the 'Prolific black wax,' with purple-black seeds, the 'Ne plus ultra' with yellow-brown seeds, the 'Long yellow six-weeks' with seeds of a light greenish-yellow color, and the 'White flageolet,' whose seed-coats are wholly without pigment, being transparent when saturated with liquids, but nearly white because of the inclusion of air when dry.

[1] Science, May 3, 1907, page 709.

[2] Read before the Botanical Society of America, at New Orleans, December, 1905.

I have this year (1905) the first generation of the hybrids, and all the crosses behaved in the expected way except those in which the 'White flageolet' entered as one of the parents. The crosses between black and brown, black and yellow, and between brown and yellow showed in every case the complete dominance of the darker pigment over the lighter. Thus, the first-generation hybrids between black and brown beans and those between black and yellow were in every case indistinguishable in color from the black parent, whether the black bean supplied the egg or the sperm. Similarly the hybrids between the brown and yellow were in each case not to be distinguished from the brown parent. But the crosses between each of these three pigmented varieties and the 'White flageolet' gave F_1 hybrids so different from either parent that, if unknown, their origin would never be guessed. These seemingly anomalous hybrids were quite indistinguishable from one another, whether the pigmented parent was black, brown, or yellow. They were characterized by a dark purple pigment, and by an aggregation of the pigment-bearing cells to form a mosaic or mottled surface. Although these hybrids were quite unexpected, it was recalled that Tschermak[2] had secured similar results in a number of cases, and Emerson[3] describes them also in crosses between 'Ultra' and 'Navy,' this being presumably the very same cross that I present here as 'Ne plus ultra' × 'White flageolet.'

Very similar phenomena have been seen by Tschermak,[4] Bateson,[5] and Lock[6] in peas, by Tschermak[4] and Bateson[5] in stocks, by Bateson[5] in sweet peas, by Correns[7] in *Mirabilis*, by Cuénot[8] in mice, and by Castle[9] in guinea-pigs. It is not because of the newness of the phenomenon, therefore, that I draw attention to the subject, but for the purpose of discussing the phenomenon of latency in the light of the accumulated data.

The appearance of hereditary characters which are not traceable to the immediate ancestry offer the most difficult problems with which the student of heredity must deal. These characters may be recognizable as having belonged to the more remote ancestry of the form in question, *i. e.*, they are atavistic, or they may be wholly new. Sometimes they occur under known conditions, at other times there is no clue to the causes upon which they may depend.

These bean hybrids which possess characters not seen in either parent furnish good examples of latency and if we can determine whence the new characters came we shall be far advanced toward a correct conception of latency. Taking, for instance, the hybrids between the yellow and white and between the brown and white, two characters may be recognized as new, *viz.*, the dark pigment and the mottled color-pattern. The fact that the very same characters appear in the hybrid offspring, no matter what the character of the pigmented parent, leaves little doubt that both of these new characters are traceable to the white parent, and we should seem to be warranted in saying that this white bean con-

[2] Tschermak, E., 'Weitere Kreuzungsstudien an Erbsen, Leukojen und Bohnen,' *Zeitschr. Landw. Versuchsw.*, **7**: 533–638, 1904.

[3] Emerson, R. A., 'Heredity in Bean Hybrids,' Ann. Rept. Agr. Exp. Sta. Nebraska, **17**: 33–68, 1904.

[4] Tschermak, *loc. cit.*

[5] Bateson, W., Saunders, Miss E. R., Punnett, R. C., 'Experimental Studies in the Physiology of Heredity,' Second Report to the Evolution Committee of the Royal Society, London, 1905.

[6] Lock, R. H., 'Studies in Plant Breeding in the Tropics,' *Ann. Roy. Bot. Gard. Perideniya*, **2**: 299–356, 1904.

[7] Correns, C., 'Ueber Bastardirungsversuche mit Mirabilis Sippen,' *Ber. d. d. Bot. Ges.*, **20**: 594–609, 1903; 'Zur Kenntniss der scheinbar neuen Merkmale der Bastarde. Zweite Mittheilung über Bastardirungsversuche mit Mirabilis Sippen,' *Ber. d. d. Bot. Ges.*, **23**: 70–85, 1905.

[8] Cuénot, 'Le loi de Mendel et l'hérédité de la pigmentation chez les souris,' *Arch. Zool. expér. et gén.*, —: 27, 1902; 'L'hérédité de la pigmentation chez les souris' (2me note), *Arch. Zool. expér. et gén.*, 4 Se., **1**: 33–41, 1903.

[9] Castle, W. E., 'Heredity of Coat-characters in Guinea-pigs and Rabbits,' Publ. Carnegie Institution of Washington, No. 23, 78 pp., Feb., 1905.

tains latent purple and latent mottling. Tschermak[10] takes just the opposite view, however, and would say that the purple mottling is latent in the pigmented bean, and that the white bean acts simply as a releasing agent which allows the latent character to become manifest. Bateson[11] also subscribes to the same view. On Tschermak's hypothesis it would appear to me a remarkable coincidence that the black, brown and yellow varieties should all contain the same latent characters, and I am forced to the conclusion just stated, that the novelties which appear in these hybrids are directly derived from the *white* parent. The new characters thus lose the mystery that otherwise invests them. They appear not as released prisoners or awakened sleepers, which had for some inconceivable reason remained inactive, but are *combination* phenomena.

The color characters of these beans are not dependent upon a single pair of units, but upon three pairs, *viz.*:

1. Pigment *vs.* no pigment.
2. Modifier which changes pigment to purple *vs.* no modifier.
3. Mottled color pattern *vs.* self color.

Of these three characters, the brown and yellow beans contain only the dominant pigment character and might be represented by the formula, *Pbm*; the black bean contains the pigment and the modification to purple, *PBm*; and the white bean contains both the modifier and the mottled color-pattern but no pigment, *pBM*. It is only because of the lack of pigment that these two characters possessed by the white bean are not apparent. *They are latent only in the sense that they are invisible.* Whenever the 'White flageolet' is crossed with any variety of self-colored bean, the three dominant allelomorphs, *PBM*, are brought together with the result seen in these hybrids, namely, a first generation characterized by dark purple mottled seeds.

[10] Tschermak, E., *loc. cit.*

[11] Bateson, W., Saunders, Miss E. R., Punnett, R. C., 'Experimental Studies in the Physiology of Heredity,' Second Report to the Evolution Committee of the Royal Society, London, 1905.

The great advantage of this explanation over that of Tschermak is that it brings these apparently aberrant results into harmony with typical Mendelian cases, and allows with a reasonable degree of accuracy, a prediction as to the composition of subsequent generations.

On the assumption that the F_1 hybrids between the 'White flageolet' and either of the non-purple self-colored beans contain the three dominant allelomorphs, *PBM*, associated with the corresponding recessive allelomorphs, *pbm*, the following forms and proportions may be expected in the second generation. In each 64 plants belonging to the second generation there should be

27 *PBM* = purple mottled like F_1.
9 *PbM* = brown mottled or yellow mottled.
9 *PBm* = purple self-colored or black.
9 *pBM* = white, exactly like the white parent.
3 *Pbm* = brown or yellow self-colored.
3 *pBm* = white (with the modifier but no mottling).
3 *pbM* = white (without the modifier but with mottling).
1 *pbm* = white (with neither modifier nor mottling).

Owing to the fact that the internal composition of the white beans has no external manifestation, the four white classes having different allelomorphic composition are indistinguishable from one another, thus resulting in a frequently found ratio for tripoly-hybrids, 27:9:9:3:16.

In this interpretation of latent characters are to be found explanations of several observed phenomena. Tschermak, Bateson and Emerson have noted that the behavior of a given character in one strain can not be used safely as a criterion for predicting the behavior of an apparently like character in another strain. A good illustration of this is seen on comparing with these hybrids of the 'White flageolet' bean, Emerson's cross between the 'Ultra' and 'Marrowfat,' the latter being likewise a white bean. The F_1 hybrids were brown mottled, thus showing that the 'Marrowfat' differs from the 'Navy' or 'White flageolet' in having no dominant pigment-changing allelomorph. The gametic formula of the 'Marrowfat' is, no doubt, *pbM*, and

in the table above, representing the F_2 of the cross between 'Ne plus ultra' and 'White flageolet' it is seen that one of the white derivatives from this cross has the same gametic composition as the 'Marrowfat.'

Emerson attempted no explanation of the different behavior of these beans, simply presenting them as exceptions to Mendel's laws or as evidences of the limitation of the usefulness of those laws in predicting the results of hybridization. Practically all of the exceptional results obtained by him cease to be exceptional when we cease to look upon the products of his crosses as monohybrids with respect to seed color. His second generation hybrids were classifiable into four categories instead of the three he expected, but his expectation was based upon the assumption that the black, brown, white, etc., are unit characters, and that the mottled hybrids were simply mosaics or blends between the white and the self-colored parents. The simple assumption, demonstrated in my hybrids, that the pigmentation and the mottling are distinct unit characters, harmonizes his results perfectly, though the numbers with which he dealt were too small for the satisfactory determination of the agreement or disagreement with the theoretical ratios of a dihybrid.

In discussing the appearance of purple spotting as a novelty in peas, Lock[12] follows Tschermak in referring the latent character to the pigmented parent, saying that "On crossing $A(B)$ (B being latent) with ab we get: F_1 $ABab$ (B latent having become B active)." If instead he had considered that Ab is crossed with aB, the A producing the pigment and the B aggregating it into spots, he would get the same F_1, namely $ABab$, but would have avoided the difficulty of a capricious unit which may be active or inactive under conditions that can not be determined. He would then have had no latent character in any other sense than that it was invisible owing to the absence of pigment.

The explanation here offered is essentially that presented by Cuénot for mouse hybrids, in which one unit is assumed to give pigmentation and another to determine the color which this pigment will exhibit. Cuénot considers the various colors to be latent in the albino and he is supported in this respect by my hybrids, but I prefer not to call this character a *latent pigment* but an *active pigment-changer*.

This reference of various colors to the action of a pigment-changer requires that the pigments upon which the various colors depend shall bear some simple relation to each other. I have made some preliminary studies on the pigments of these beans and have partially demonstrated this simple relation by converting the yellow and brown pigments to black by the use of alkalies but I have not yet been able to reverse the process. It is easily demonstrable that the black (dark purple) bean contains anthocyan, and this gives a simple explanation of the correlation between black seed-coats and red flowers, observed by Mendel and all other students who have chanced to use black-seeded peas or beans.

That the yellow, red, and black pigments of animals are closely related is also well known, and there can be no doubt that the 'latent black' which Castle[13] reported in certain albino guinea-pigs is to be interpreted exactly as Cuénot's mice, the black being due to the presence of a melanizer which is a unit character wholly independent of the pigment-producing unit. The fact that half the gametes of this individual carried the so-called 'latent black' simply showed the animal to be heterozygous with respect to this allelomorph, and the extracted recessives which did not in subsequent generations produce any black offspring could not do so for the simple reason that the pigment-changing unit had acted in a perfectly normal way and had been absolutely separated out into the black offspring while its recessive counterpart was segregated with equal purity into the non-black.

A very important consideration in this connection is the frequency with which the new character is atavistic. This shows the process

[12] Lock, R. H., 'Studies in Plant Breeding in the Tropics,' *Ann. Roy. Bot. Gard. Perideniya*, **2**: 299–356. See p. 341.

[13] Castle, W. E., *loc. cit.*

by which these various color varieties were originally produced. The original character was compound and the new variety was produced by the loss of one or more of the components. In other words these varieties are retrogressive. Beginning, for instance, with a purple mottled bean, one variety was formed by the loss of the mottling, another by the loss of the pigment, and another by the loss of the pigment-changer. Then by hybridization every possible combination of these three characters became the constant characteristics of distinct strains. When these varieties are crossed together the original variety may be reproduced by bringing together the several component parts of the original compound character.

There are still many mysteries regarding latent characters or qualities, but I believe the considerations here presented bring a large number of otherwise anomalous phenomena into perfect harmony with typical Mendelian cases of alternative inheritance. It appears to me certain that this conception of latent characters as *invisible* ones, which has already been used by Correns[14] to interpret in part the behavior of Mirabilis hybrids, can be extended to clear up his remaining difficulties, and that Bateson will find in the same conception an explanation of the complex behavior of his sweet peas and stocks without resort to the inexplicable synthesis and resolution of supposed hypallelomorphs.

George Harrison Shull
Station for Experimental Evolution,
Cold Spring Harbor, Long Island,
December, 1905

[14] Correns, C., 'Zur Kenntniss der scheinbar neuen Merkmale der Bastarde. Zweite Mittheilung über Bastardirungsversuche mit Mirabilis Sippen,' *Ber. d. d. Bot. Ges.*, **23**: 70–85, 1905.

QUOTATIONS

THE UNIVERSITY OF OXFORD

This appeal is now made on behalf of Oxford by the Chancellor and Vice-Chancellor of that University, and it is to be enforced at a public meeting of all persons interested in the subject to be held in London on Thursday, May 16, with the Chancellor of the University in the chair, supported by many men of light and leading from among those whom the University has already trained for the high station they adorn in Church and State. The appeal, however, is not made to old Oxford men alone; it is addressed to "all who are interested in the continued wellbeing and usefulness of the oldest University in the Empire." Nor is it in its present form and purpose an appeal for the complete equipment of the University with all the appliances, institutions, and endowments which would enable Oxford to hold her own in the coming time among the leaders in all departments of letters, learning, science, and the arts. That is an ideal which would require millions for its effective and practical realization. Cambridge has already asked for something like a million and a half and could probably find plenty of use for as much again. American Universities are almost daily being endowed on this hitherto unprecedented but by no means extravagant scale. Oxford is, for the present, less ambitious and perhaps more practical. She recognizes that even for Universities it is true that *non omnia possumus omnes*. The days are gone by, perhaps, when any University, even a multimillionaire University, can profitably do as Bacon did when he aspired to take all knowledge for his province. Hence such new endowments as Oxford now hopes to obtain—£250,000 is all that is asked for at present, merely a paltry million dollars as American founders and benefactors might regard it—are to be directed into certain definite channels. Largely at the instance of Mr. T. A. Brassey, who has already set a goodly example by his active exertions and personal munificence, a scheme has been prepared which had received the hearty approval of the late Chancellor, Lord Goschen, before his death, and is supported by many high academical authorities and by a number of old Oxford men of the highest capacity and experience in many walks of life. An outline of this scheme will be found in the letter of the Chancellor and Vice-Chancellor. It includes provision for the promotion of modern studies, literary and scientific, such as modern languages, electrical research, the scientific basis of the training of