

Letters to the Editor.

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Superconductivity a Polarisation Phenomenon.

WITH the collaboration of my research associates, Messrs. A. C. Burton, A. Pitt, and J. O. Wilhelm, evidence has just been obtained that an orientation effect of some kind must be involved in the phenomenon of superconductivity in metals either directly or in its demonstration in ordinary direct current experiments.

We have been investigating the high frequency resistance of lead wires, and have found that while this resistance steadily decreased with lowering temperature, no abruptness occurred when the critical temperature of lead, 7.2° K., was reached. The experiments were carried down to 2° K. without any superconductivity discontinuity being observed. In these experiments frequencies as low as 12×10^6 per second have been used, and other experiments with lower frequencies are now in train.

The experiments show that 'the time of relaxation' of the orientation phenomenon for lead is large compared with the time period of the longest of the oscillations used, namely, 10^{-7} sec.

It seems clear that with lead maintained at the temperature of liquid helium, 4.2° K., superconductivity must appear with the application of electric fields with a frequency somewhere between 12×10^6 seconds and zero. The results obtained would seem to indicate a promising path to follow for the elucidation of the phenomenon of superconduction in metals.

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Chemical Effect of a Mendelian Factor for Flower Colour.

IN a letter published in NATURE of June 27, 1931, Miss Scott Moncrieff mentions an interesting case of flower-colour inheritance in *Pelargonium*. On selfing, a rose-pink variety gave seventeen offspring like itself and three others producing salmon-pink flowers. The rose-pink petals contained the anthocyanin pigments, cyanin and pelargonin (the latter only as a trace); the salmon-pink petals, pelargonin only. That is, the dominant factor in colour inheritance causes cyanin to be formed almost entirely instead of pelargonin. This factor, therefore, as pointed out by Miss Scott Moncrieff, brings about the insertion of a hydroxyl group in the phenyl ring, which process may be regarded as one of oxidation.

Such a phenomenon as that outlined above is not necessarily limited to colour-varieties. Among the higher plants, one finds, for example, in some phyla, the dihydroxy grouping (characteristic of catechol) dominant among the compounds formed in the metabolism of aromatic substances. In others, apparently, the trihydroxy grouping (characteristic of pyrogallol) prevails. Thus, there is, on the whole, a restriction of catechol tannins to some genera and orders and of pyrogallol tannins to others. Again, in regard to the flavone pigments—compounds closely resembling the anthocyanin pigments in structure—apigenin (one hydroxyl group in the phenyl ring) is found in some genera, luteolin (two hydroxyls in the phenyl ring) in

others, and so forth. Or, in regard to varieties, the ivory-flowered variety of *Antirrhinum majus* contains apigenin, the yellow-flowered, luteolin. Here, again, a difference of one hydroxyl in the structure of the molecule represents a factorial difference, as in the case of *Pelargonium*. In the flavone pigments of *Antirrhinum*, however, in contrast to the anthocyanin pigments of *Pelargonium*, the dominant factor suppresses oxidation.

It is a natural desire to interpret such Mendelian factors in biochemical terms. Such an interpretation has apparently defied the biochemist for many years. Some seventeen years ago, Willstätter had identified the anthocyanin of the type of the cornflower (*Centaurea cyanus*) as cyanin; of the pink variety, as pelargonin. To students of genetics, it is clear that here, between type and variety of *Centaurea*, there is, in all probability, one Mendelian factor. The biochemical interpretation of factors for colour is, however, part of a greater problem, namely, that of the origin of anthocyanin in the plant. Clearly defined cases of factorial differences between anthocyanin types and albino varieties have been known for many years in the sweet pea, stock, *Antirrhinum*, and other plants. Here, different varieties incapable of producing anthocyanin exist which, on crossing together, give types fully coloured with this pigment. In these well-known varieties lies the secret, as yet unrevealed, of the biochemical reactions which control the formation of anthocyanin.

From more general considerations, some suggestions may be made. Here they can only be mentioned in outline, and many subsidiary points remain unexplained. Anthocyanin pigments are found, on the whole, in flowers, fruit, young leaves, autumnal leaves, and leaves subjected to drought and injury. They are, apart from varieties such as the copper beech, not found in the normal green assimilating leaf. Two fundamental conditions are characteristic, in general, of organs producing these pigments as contrasted with those from which the pigments are usually absent.

First, in flowers, fruits, young leaves, and autumnal leaves, photosynthesis is less than in the normal leaf, or may have ceased altogether. This, as recent work on nitrogen metabolism has demonstrated, leads to hydrolysis of proteins and subsequent de-amination, with production of the residues of amino-acids, both aliphatic and aromatic. Secondly, in some of the organs quoted above, there is relatively little protection against loss of water, and, moreover, in the case of petals, fruits, and autumnal leaves, approaching separation from the parent plant and other causes render supply of water increasingly difficult. The connexion of appearance of pigment with lack of water from the soil may be very obvious. I have at the moment under observation a young plane tree, a few feet high, growing in a very dry situation. All the developing leaves are brilliantly red, giving the effect, from the distance, of a plant in flower. Such an abundance of pigment is not usual in the normal young leaf of the plane.

The deduction drawn from many observations connected with the two conditions mentioned above is that anthocyanin pigments are produced from the residues of aromatic amino-acids after de-amination. Under conditions of relative desiccation, condensation among these residues takes place with formation of anthocyanin pigments. As recently shown from the researches of Ruhland and his co-workers, de-amination of amino-acids occurs both in young leaves in active growth and in leaves in which photosynthesis has ceased; the latter state, moreover, is characteristic of petals, fruits, and autumnal leaves.