

my previous conviction: "This rush of the teachers toward experimental psychology is an absurdity."

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THE NEW CASES OF TOTAL COLOR BLINDNESS.

The results of the interesting observations upon a color-blind person (and in part upon two other color-blind persons) which were made by Professors Hess and Hering, and which are reported upon on another page (p. 532), are summed up by the authors in these words: "The hypothesis of König and v. Kries, in accordance with which the totally color-blind differ from those who have normal vision either by the absence or by the functionlessness of the cones, finds no support in our observations." This conclusion is expressed with the carefulness and freedom from exaggeration which are customary with its authors; it is true that the case of achromasia here reported upon does nothing to strengthen the theory referred to. (I shall speak of the case in the singular, as do the authors in their conclusion—as that of Frl. F.—though many of the observations made upon her were confirmed in the other two instances.) If normal cones are wanting in the fovea, then it would seem that the situation must be capable of being described in one of the three following ways: (1) there must be no visual elements there which are capable of performing any function; (2) there must be cones which (whatever their external shape may be) are undistinguishable from rods as regards their effective photochemical contents, or (3) the regular rods must extend over the whole surface of the retina, including the fovea where they are normally wanting. In the case of Frl. F. it seems to have been conclusively made out that there was no defect of vision in the fovea, and hence the first state of things above described is distinctly excluded. The case is not so simple for the other two alternatives; experimental evidence was obtained which had some bearing upon the third alternative, but not conclusive bearing; if there had been normal rods in the fovea, and if all normal rods contained the visual purple, then it would seem (if we adopt the hypothesis that the growth of the visual purple is the source of the adaptation to a faint light) that Frl. F. ought to have been deficient in that defect from which the normal eye suffers, the night blindness of the fovea; that is to say, her fovea ought to have undergone, unlike the normal fovea, the same adaptation to a faint light as does the rest of the retina. This was found not to be the case, and it can, therefore, safely be inferred that her fovea is,

as in the eyes of the rest of us, deficient in *visual purple*; but it cannot be inferred with equal safety that it is not provided with *rods*. It is well known that not all the rods contain the visual purple; we are expressly told by Kühne that that pigment is wanting not only in the extreme periphery, but also in the rods which are found infrequently in the immediate vicinity of the fovea. If, therefore, we had had to make a prediction as to whether, on the hypothesis that there were in a given instance rods instead of cones in the fovea, those rods ought to furnish ground for the existence of the Purkinje phenomenon, it would have been distinctly the safer course to suppose that they would not do so; and certainly it cannot be inferred from the absence of the Purkinje phenomenon in the fovea of Frl. F. that her fovea is wanting in rods, but only that it is wanting in the pigment of the rods. It would be rather a far cry from the one inference to the other even if all other rods, as far as known, did contain the rod-pigment; but since the rods which are in the immediate vicinity of the fovea are known *not* to contain it, the inference is a quite impossible one. It seems odd that this obvious objection to their argument did not suggest itself at once to these distinguished experimenters.

The second hypothesis of those above enumerated is not affected by the case of Frl. F. If the fovea is supposed to be occupied by cones which are simply in a sufficiently undeveloped state not to furnish any sensation of color, no reason exists for saying that their development has been arrested at one stage rather than at another, and certainly no reason exists for saying that they must of necessity contain the purple coloring matter of the rods. And, in fact, Hess and Hering do not affirm that their experiments have force against the hypothesis regarding the nature of total color-blindness in this one of its three forms (which is the one in which I defend it).

But, even if it had been rigidly shown that the achromasia of Frl. F. was not in any way due to the rod-like structure of the visual elements of her fovea, the hypothesis which is here in question would be very far from being disproved by her case, or even by all three of the cases which were apparently of a very similar nature. It is true that three cases are a goodly number when it is considered how rare well-authenticated cases of total color-blindness are, but it is not sufficient to upset the conclusions which are to be drawn from a much larger number of cases which are different from these. The additional phenomena which are usually attendant upon achromasia—nystagmus, avoidance of a bright light, and diminished visual acuity—were *all* wanting in the cases here tested; these were, therefore,

plainly exceptional cases and not such as should furnish a basis for general conclusions. Professor Müller, among others, has pointed out that nothing can be farther from a legitimate deduction from the present view in regard to the distinct function of rods and cones (which he also adopts) than to suppose that *all* cases of congenital dyschromasie are due to anomalies in the retina. When the dyschromasie is acquired, it is well known that it is most frequently an attendant symptom of disease of the optic nerve or of the higher centres. It is markedly different in this respect from night-blindness, which is the characteristic symptom of pigmentary degeneration of the retina, which latter disease is now supposed to start from a pathological proliferation of cells in the pigment epithelium, a membrane which, since it secretes the rod-pigment, may be regarded as of the nature of a gland, and hence subject to diseases of its own. (Since the night-vision, which night-blindness is the absence of, is achromatic vision, or gray-vision, an additional strong ground is here to be seen for the assumption that the latter is the function of the rods exclusively.) But if acquired lack of the color-sense is seldom, if ever, associated with defects in the retina, it would be strange if congenital color-blindness were not at least sometimes due to defects of the nervous apparatus. The result of this work of Hess and Hering, therefore, need not be anything more than to force an upholder of this hypothesis to the assumption that there are two forms of total color-blindness—one (with nystagmus, foveal blindness and avoidance of high lights) due to a defective condition of the cones, and the other, without those attendant symptoms, due to some difficulty in the nerves of conduction or in their receiving stations. And this latter form is much the least frequent. It is certain that the totally color-blind boy whom Professor König had in his laboratory in the summer of 1894 had no vision in his fovea (though no one had ever discovered it until after the knowledge of the normal night-blindness of the fovea caused it to be specially looked for). Of a group of small, bright objects, he constantly lost one out of sight; and it was only necessary to stand in front of him, and ask him to look at you, to see plainly that in his effort to look you straight in the eye he was obliged to turn his eyeball markedly to one side.

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THE CRITERIA OF MENTAL ABNORMALITY.

It is my purpose to discuss briefly the criteria which theoretically discriminate normal mentality from that which is abnormal. Psy-