be employed, for it has a shorter distance to travel. Thus, the author believes, the right hand receives more education and gradually assumes predominance.

Mr. Parson's apparatus for determining right- and left-eyedness is inadequately described in the book, but consists of a stereoscope face-piece attached to an enclosed box containing shutters by means of which the preferential use of the right or left eye is determined. This is called a "manuscope," a name as unwarranted as the author's statement that "eyedness is cause and handedness effect." There is no measure given of the reliability of the following results, obtained from the examination of school children of Elizabeth, N. J.:

604 subjects were right-handed and right-eyed
225 subjects were right-handed and left-eyed
4 subjects were left-handed and right-eyed
32 subjects were left-handed and left-eyed

The subject's own statement was taken as the criterion of right- and left-handedness. Handedness corresponded to eyedness in 74 per cent. of the cases. But we may analyze the author's results as follows:

If right-handed, the chances that a subject will be right-eyed are 72 in 100.

If left-handed, the chances that a subject will be left-eyed are 89 in 100.

If right-eyed, the chances that a subject will be right-handed are 99.3 in 100.

If left-eyed, the chances that a subject will be left-handed are 12 in 100.

Mr. Parson's hypothesis could be reversed and it would work quite as well. He could have assumed an original right-handedness and have derived his right-eyedness. An originally greater activity of the right arm would introduce the infant's hand more frequently into the right than into the left eye's line of vision. Thus more habits would be built up about foveal stimulation of the right eye, and right-eyedness would result from original right-handedness. All that is needed to disprove the author's thesis that right-handedness is derived from right-eyedness is a left-handed baby congenitally blind in the left eye. It would be well to look for such a case.

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SPECIAL ARTICLES

QUESTIONNAIRE ON CERTAIN FACTS BEARING ON THE THEORY OF SEXUALITY AND CHROMOSOME CONSTITUTION

IN order to obtain a clearer understanding of the phenomena of sexuality the writer has put the following questions to himself while attempting to arrive at a proper theory of sex and sex determination. They may be of use to others who may be wandering about in a slough of despond if not in a fool's paradise, vainly attempting to satisfy their minds that the hypothesis of homozygous and heterozygous sex potentialities or "sex chromosomes," still so naïvely held, is the explanation of the nature and cause of sexuality and sexual states, when at best it could never be more than an explanation of unisexuality and dieciousness as contrasted with hermaphroditism and bisporangiateness. Certainly any one intent on finding a way to the truth must be confused if he still entertains such an hypothesis after he has become aware of the fact that organisms, both plant and animal, with allosomes nevertheless can be reversed, the female to the male and the male to the female condition in spite of the fact that one sex in the given case has a homomorphic set of allosomes and the other a heteromorphic set.

(1) If maleness and femaleness are the result of and conditioned on the presence of specific sex genes or potentialities, how does it happen that a cell lineage (either with haploid or diploid chromosome complements) without a change of chromosome content, without aggregation (fertilization) or segregation (reduction) can nevertheless pass successively from (1) a neutral state, to (2) a female state, to (3) a neutral state, to (4) a male state?

(2) Why are the staminate and carpellate branches of various monecious plants just as fixed in their sex and just as extremely dimorphic as they are in diecious plants?

(3) If sexuality is a matter of hereditary factors either simple or multiple, why did the higher plants with an alternation of generations evolve a condition in which sex segregation or sex determination never follow reduction, and in which sex determination usually (except in the case of the rather rare diecious plants) does not follow promptly on fertilization, but male and female determinations take place during the vegetative period of the diploid sporophyte?

(4) If in some organisms, with allosomes, in which there is a homozygous condition in one sex and a heterozygous condition in the other, these conditions are regarded as the cause of sex determination, sex production or sex stability, how does it come about that not only the heterozygous sex can be reversed to the opposite condition but the assumed homozygous sex can also be reversed, sometimes as readily as the heterozygous one? How does the homozygousness in relation to sex change to heterozygousness?

(5) If it is assumed that in the heterozygous individual, in respect to allosomes, one allosome was dominant over the other in determining sex and then, in case of sex reversal, necessarily becomes recessive

through some special functional state brought about by the environment, how do we know that a similar functional state was not present and responsible for the determination of the original sexual state?

(6) If allosomes have such a profound influence in the diploid condition, whether in homozygous or heterozygous association, as has recently been generally assumed, how does it come about that they are entirely impotent to influence the sexual state whether secondary or primary in the haploid cell generations following reduction, when we know that the haploid and diploid conditions do not interfere with either gametophytic or sporophytic expressions, but that either a haploid or diploid state gives a normal or nearly normal gametophyte and also a normal or nearly normal sporophyte?

(7) What is the cause or factorial mechanism if any that determines the sex of a specific region in diploid and haploid hermaphrodites and in diploid and haploid, bisporangiate sporophytes?

(8) Why are haploid unisexual gametophytes and diploid diecious sporophytes without allosomes often just as fixed in the given sexual state and just as dimorphic as similar gametophytes and sporophytes with clearly recognized allosomes?

(9) Why are organisms with allosomes often as easily sex-reversible as organisms that have no such specialized chromosomes?

(10) If in Sphaerocarpus the allosomes are assumed to be the direct cause (factorial hereditary cause) of maleness and femaleness in the gametophytes with which they are associated, how does it happen that when they are together no dominance is shown, but the resulting generation is completely neutral and nonsexual, when in other cases such a heteromorphic pair of chromosomes is assumed to have the one a dominant factor or group of factors and the other a recessive factor or group of factors and to be all-potent in bringing about sexual states in the diploid condition?

(11) If hereditary constitution is responsible for the sex of identical twins, how does it come about that in the diecious Arisaema triphyllum, while the twins are still connected by a bridge of living tissue one can nevertheless be induced to become a male and the other a female?

(12) If dieciousness in the higher plants is caused by segregating "sex chromosomes" or allosomes or by some other possible Mendelian factorial condition, how can the facts be explained that in the diecious Acer platanoides, for example, quite frequently one or more flowers, flower clusters or branches on a staminate tree will show sex reversal to the female condition and in the same way sex reversal will be shown on a carpellate tree to the male condition, and that not only will the sex reversal in either case bring forth normal development of the opposite set of sporophyll on the tree but will at the same time induce reciprocal vestigial development of the sporophylls characteristic of the individual as a whole, so that in the reversed parts the carpellate tree will have vestigial gynecia and the staminate tree vestigial stamens?

(13) How can any theory of sex based on the idea of male and female determiners or chromosomes explain the fact that frequently in Acer saccharinum, a diecious species, certain branches will nevertheless produce first carpellate flowers, with stamen vestiges, later with further growth, staminate flowers with carpel vestiges, and still later carpellate flowers again, also with stamen vestiges?

(14) If any factorial basis is assumed to explain the dieciousness of Morus alba, how can the fact be explained that a staminate tree sometimes produces a branch which for years bears both carpellate and staminate catkins and in addition bisporangiate catkins, while the individual as a whole continues to be staminate, when we know that the carpellate plant is also "heterozygous for sex" and frequently produces similar branches?

(15) What convincing evidence is there to show that allosomes are not merely the results of sexuality rather than the cause of it, and that they follow the sex rather than determine and control it; and further, what definite evidence do we have to show that sex determination is not always physiological and sex stability or persistency merely a phenomenon of differentiation?

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WHY DO CILIATED ANIMALS ROTATE COUNTER-CLOCKWISE WHILE SWIMMING?

WHILE studying the development of certain prosobranch gasteropods several years ago three distinct phases of their normal swarming reactions were observed which so far as I can learn have never been recorded.

The recent work of Grave and Schmitt, Haywood, Wyman and others on the physiology of ciliary action and the histology of the cilium leads me to record these observations and other studies suggested by them in the hope that some worker in this field will interpret the phenomena.

One can not observe a group of these gasteropod larvae just before swarming begins, while they are still surrounded by the protecting jelly-like albumen in which the eggs were laid, within or without a capsule, without being impressed with the great