apparently different factors, but by simply lumping them under a common name. Nor is a rationale given of the affirmed reversal of sex, which Schlechter and other authorities moreover wholly deny. Despite these and other faults and failures the work is interesting and often suggestive, and that not only on account of its theoretic position but its sanguine proposals for the practical control of sex.

The work of Düsing (1883), while less speculative, is of great importance in respect to the causes which regulate the proportions of the sexes ; since, instead of falling back with Darwin on the unexplained operation of natural selection, he seeks to note the circumstances in which a majority of one sex is profitable, and to show that organisms have really the power to produce in such circum­stances a majority of one sex,—in short, that disturbances in the proportion of the sexes bring about their own compensation, and further supports these views by calcula­tion and statistical evidence.

He separates the causes determining sex into those affecting (*a*) one parent and (δ) both alike. Starting with a minority of one sex, he emphasizes the importance of delayed fertilization, accept­ing it as a fact that females late fertilized bear most males (this corresponding in man to a scarcity of males among the lower animals). He notes that the firstborn child is most frequently a male, especially among older persons, and thus explains how after a war, when there is a want of males, most male children are born. He ascribes importance to the amount of sexual intercourse. Thus, suppose a minority of females : their fertilization tends to occur more frequently, and thus (if the general statement be correct) they should produce a majority of their own sex ; or similarly with males. This is supported by reference to cattle- breeding, and it is interpreted physiologically to involve that young spermatozoa produce a majority of males. Suppose a great majority of males : the chances of early fertilization of the females are of course great, but eggs fertilized early tend to produce females. Or suppose conversely a great minority of males : the chances of early fertilization are small, but old eggs tend to produce males, and either excess will thus become compensated. Or again, the more decided the minority of one sex the more frequent the sexual activity of its individuals, the younger their sexual elements, and consequently the more individuals of that sex are produced. Düsing next takes up as indirect causes equivalent to a minority of individuals—(*a*) deficient nutrition ; just as fre­quent copulation overstrains the genital organs the same result may arise from the deficient nutrition of the system ; hence an ill- fed cow yields a female to a well-fed bull and *vice versa* ; (b) relative age ; the nearer either parent is to the period of greatest reproduc­tive capacity the less, he thinks, is a birth of that sex probable.

As factors affecting both parents he first discusses variations in nutrition ; although means of subsistence may decrease, there is at first no decrease in the number of progeny. But it is necessary to distinguish the reproduction of the species from its multiplication, so that in defective nutrition, though an animal may not reproduce less, it will permanently multiply much less. He agrees with Darwin that the reproductive system is most sensitive to changes of nutrition; gives cases showing the effect of abundant nutrition on reproductive activity, notes the influence of climate, function, &c., and contrasts organisms of high activity, like birds and insects, with parasites. The nutritive relations of the sexes are also contrasted ; since females have to give to the embryo more than the male, they are much more dependent on food for vigour of their reproductive capacity, and hence the frequent contrast of their size, &c. Furthermore, animals suit their multiplication to their conditions of nutrition ; if food be abundant there is an increase in the number of females, and therefore a further increase in number of individuals of the species ; if food, however, be too scarce the more males are produced and the number of the species tends to diminish. Hence the connexion above mentioned between increase of children (especially females) in prosperity and after a good harvest, and the rising proportion of boys during a rise of prices. Similarly for animals : the more food the more females, and the more rapidly the species increases ; the less food the more males, and the less rapid the increase. Again, plants on good soil produce more female flowers and more seed with profit to the species ; on bad soil male flowers preponderate, mostly perish, and the species tends to disappear. The extreme case of optimum nutrition tends to produce normal parthenogenesis (“thelytokie ”), yielding only females, different in cause and operation from the parthenogenesis resulting from the absence of males (“arrenotokie”). @@1

*Theory of Reproduction and Sex.—*If we now at tempt to reach a rational standpoint from which to criticize and compare the innumerable empirical conceptions of sex,— much more if we seek a firm basis for the construction of a really comprehensive theory,—it is evident that such a theory must be addressed not merely to the specialist concerned with problems of reproduction and development, but, while embracing details and anomalies, must be satis­factory alike to the general morphologist and physio­logist. We must therefore have before us that conception of the main lines of thought on each of these subjects which has, been outlined under the headings Physiology and Morphology.

The close coincidence between these two independent developments is especially to be noted. From the vague account of general form and appearance, of habits and temperaments, which made up the descriptive natural history of the past, the two streams of progress, though distinct, are wholly parallel. Thus Buffon furnished a brilliant and synthetic exposition of the oldest view, while one side of their general aspect received new precision at the hands of Linnæus,—to some extent the other also at the hands of his physiological contemporaries. The anatomical advance of Cuvier is parallel to the detailed study of the functions of the organs, while the great step made by Bichat lay in piercing below the conception of the organ and its function as ultimate, and in seeking to interpret both by reference to the component tissues. The cell- theory of Schwann and his successors analysed these tissues a step farther, while the latest and deepest analysis refers all structure ultimately to the substance called protoplasm, and similarly claims to express all function in terms of the construction and destruction, synthesis and analysis, anabolism and katabolism of this. See Physiology, Proto­plasm, Morphology.

Now, since every morphological and physiological fact or theory is in one or other of these few categories, it is evident that we have here the required criterion of theories of reproduction and sex. The question, What is sex? what is meant by male or female ? admits of a regular series of answers. The first and earliest is in terms of general aspect, temperament, and habit, and, though crude, em­pirical, and superficial, it lacks neither unity nor usefulness. At this plane are not only most popular conceptions but many theories like that of Starkweather, which may be mentioned as the most recent. The anatomist contents himself with the recognition of specific organs of sex, or at most with a similarly empirical account of their functions ; while the embryologist and histologist will not rest con­tented without seeking to refer these organs to the tissues of which they are composed and the layer from which they spring, and even reaches and describes the ultimate cellular elements essential to sex,—the ovum and spermatozoon. A parallel physiological interpretation of these is next required, and at this point appear such hypotheses as these of Weis- mann and others.

Thus the bewildering superabundance of widely dif­ferent theories at the present juncture becomes intelligible enough ; and, each once classified according to its stage of progress, a detailed criticism would be easy. But this is not enough : the demand for an explanation at once rational and ultimate, to comprehend and underlie all the preceding ones, is only the more urgent. Where shall we seek for it ? On the one hand the morphological aspect of such an explanation must interpret the forms of sex cells in terms of those of cells in general, and in terms of the structural properties of protoplasm itself ; while its more difficult yet more satisfying physiological aspect must express the mysterious difference of male and female in terms of the life processes of that protoplasm,—in terms,

@@@1 See Düsing, *Jena Zeitsehr.,* 1885 ; Starkweather, *Law of Sex,* 1883.