are the physiological stimulus which awakens the development of the auxiliary and secondary sexual characters.

Auxiliary primary and secondary sexual characters are so many and various that general statements regarding them are difficult and uncertain. In the broadest fashion, however, the following generalizations appear to be true. Secondary sexual characters begin to appear at puberty. Young or immature forms resemble the sex in which such characters are least marked, while the young and the undistinguished sex resemble ancestral forms. The sex that is distinguished is usually the male, and the characters are usually hypertrophies or specializations of characters that appear in the females and the young. (It is to be remembered that specialization may be the result of the suppression of characters as well as their acquisition, and there are a remarkable number of cases in which we may, at least tentatively, picture the bright sexual colour of males as due to the suppression of a pigment which masks them in the female.)

*Hermaphroditism* is the condition in which gonads producing ova and gonads producing spermatozoa are contained in the same individual. Its distribution in the animal kingdom is irregular, and apparently independent of natural affinity, and the balance of opinion is in favour of regarding it not as a primitive condition, but as a secondary acquisition. C. Claus has pointed out that it is frequent among sessile animals, as for instance Sponges, Anemones, Corals, Polyzoa, bivalve Molluscs, and Tumcates, and sluggish animals such as many of the worms and snails, whilst it is extremely common amongst almost every kind of parasitic animal. The obvious suggestion is that if the condition be primitive, it has been preserved, and if not primitive, acquired, because in animals of such habit, the chances of sexual congress would be greater than if the sexes were separate. Against such an interpretation, however, it must be noticed that in most hermaphrodites the sexual maturity of the male and female gonads is not coincident, so that cross-fertilization commonly occurs. Self-fertilization is said to occur in the fish *Serranus,* and it certainly occurs in many parasitic Trematodes, in Tape­worms and a few Nematodes. The real meaning of the occurrence of the condition remains obscure. Both gonads are present in many Sponges, in the Ctenophora, in many Anemones and Corals, in degenerate Hydroids such as *Hydra,* in most Turbellarians and Trematodes, in all the Tapeworms, in a few Nematodes, in many Chaetopods, in the Leeches, in a few Brachiopods and in many Polyzoa. It is absent in most Echinoderma and Arthropoda, but occurs in Cirripedes and some Isopods. It occurs in some bivalves, such as the common oyster, cockle and clam, and is present in the Euthyneurous Gastropods and in Pteropods. Amongst vertebrates it is rare. A number of observers have urged that the vertebrate embryo passes through a hermaphrodite condition. J. T. Cunningham and F. Nansen have stated that a testis is embedded in the ovary of the young hagfish (*Myxine)* and that this ripens before the ovary, but later observers have disputed their interpretation of the facts. In a few fish and some Batrachia, hermaphroditism has been demon­strated, but it is not certain, whether as a normal or aberrant occurrence, whilst in many of the Batrachian cases, the animals are known to be normally unisexual. The term hermaphroditism, however, has been applied frequently to cases of a different kind, in which there is no evidence of the essential sexual organs being affected, the appearances relating wholly to the auxiliary primary or the secondary sexual characters. It is most probable that such conditions differ entirely from true hermaphroditism. With regard to the auxiliary primary organs, and especially the genital ducts and external organs of sex, in a majority of cases as in vertebrates, the embryonic or youthful condition is undifferentiated, and so to say, contains the initial material which may be elaborated by specialization in one direction or the other, by the proliferation of certain portions and the suppression of others, into the structures characteristic of the male or of the female. Sometimes, growth takes place without normal differentiation, sometimes the specialization in one direction lags, with the result that a dubious appearance arises. Subsequent dissection or the approach of maturity, however,

make it plain that the dubiety was superficial and that the gonad of only one sex was present. Among mammals, including man, every normal male retains reh\*cs of the female side of the undifferentiated condition of the accessory sexual organs, whilst every normal female contains similar if less well-marked relics of the male condition. Apparent hermaphroditism depending on a dubious condition of the secondary sexual characters is equally widespread in possible occurrence. Amongst insects which have been much studied, such as the butterflies and moths, many curious conditions have been described; sometimes the pattern and colour of the upper and under sides, sometimes of different parts of the same wing, sometimes of different wings, present the characters of different sexes. Among birds and mammals, the secondary sexual characters of one sex, such as size, pattern or colour, weapons or habits, may appear in animals with the gonads of the other sex, in every degree of development, reaching to an apparently complete reversal. In many cases these abnormal occurrences are associated with arrest of the functional activity of the primary organs of sex, by disease, accident, or decay, and the failure of the necessary stimulus would certainly serve to explain cases where the apparent reversal is no more than the suppression of a specialization in one direction. The facts, however, go further; it appears as if the suppression of femaleness allows the development of a latent maleness.

*Determination of Sex.—*Answers to the question why a particular individual becomes a male or a female fall into two groups, in one of which it is supposed that external conditions determine the result, in the other that the sexual cells differ from the first. G. Canestrini suggested that the sex was determined by the number of spermatozoa which entered the ovum, but fuller knowledge of the details of fertilization (see Reproduction) has made it plain that only a single spermatozoon, normally conjugates with the ovum, whilst polyspermy, if it occur, results only in abnormalities which do not proceed to full development. Professor Thury in 1863 and C. Düsing in 1883 urged that ova fertilized soon after ovulation gave rise to females, whilst those impregnated later produced males. Some evidence exists as to the effect of delay in fertilization; V. Hensen (1881) suggested that females were produced when both ova and spermatozoa were in the most active condition, and H. M. Vernon (1898) has shown that in hybridizing Echinoderms the fresher gamete appears to exert a greater influence, but it cannot be said that there is definite evidence as to the determination of sex on such lines. J. D. Hofacker in 1823 and M. T. Sadler in 1830 collected a large series of statistics from which they drew the conclusion that when the male parent is older, more males are produced, whilst many observers have attempted to draw conclusions from the comparative vigour of the parents. Popular belief and some observations with regard to the breeding of domestic animals have led to the inference that the sex of the offspring tends to be that of the least vigorous parent, and such a theory, as it would appear to imply the existence of a natural law for rectifying the proportions of the sexes, has gained more attention than the facts supporting it would justify, and several unbiassed observers have interpreted the events in the sense that the vigorous parent produces his or her own sex. It is to be noted that such theories of relative vigour do not necessarily imply that external conditions determine the sex, for they would apply equally were it the case that there was a power of selection amongst gametes of predetermined sex. A large number of investigators have been led to believe that conditions of nutrition are of importance, and this view is specially plausible in the case of vertebrates, if it be accepted that the embryos pass through a hermaphrodite condition. E. Yung found that when tadpoles were reared under normal conditions, the proportion of male to female was about as 43 to 57, but that when a flesh diet was provided the percentage of females was very greatly increased. It has been noted that when Aphides are under the favourable conditions of summer temperature and nutrition, they produce only females, but that the advent of autumn brings with it an equality in sex production. Mrs Treat showed that starved