The Study of Taxonomic Zoology.

THE proper study of any aspect of zoology involves the consideration of the following facts: (1) the external world, in contradistinction to the organism, is undergoing constant and ceaseless change; (2) the organism itself is similarly subjected to change; (3) the organism and its environment are in a constant state of reaction. The physical sciences aim at a correct understanding of what is happening in matter in its innumerable aspects and the reality underlying these changes. The biologist seeks to elucidate the phenomena connected with the organism, but his study is never thorough unless an attempt is made to correlate the relation of the changing organism to the external world. It is not possible to explain correctly the form, shape or function of a particular organ, or the behaviour of a particular organism and its relationships to other organisms, without taking into account the third consideration mentioned above, in other words, that every organism is trying to fit itself to live in its particular surroundings. This effort on the part of the organism is, to a large extent, conditioning its structure, its behaviour and its life-processes.

The primary object of taxonomy, or the systematic study of a group of animals, is to discover their relationships and to facilitate the advancement of this object by assigning to groups of individual kinds of organisms generic and specific names, grouped into more comprehensive sections such as families, orders, etc., according to the method instituted by Linnæus. Such names when first proposed must be accompanied by a description of the animal to which it applies, in which, so far as is possible, its relationships must be emphasised. It is assumed that the manifestation of relationship is resemblance, and in order to establish the affinities of one species with another they must be generally similar in structure, development, behaviour and habits. Practically, however, complete information about an organism is very often not available, and the systematist has therefore to make the best of the data at his disposal (which at present is for the most part morphological) in expressing an opinion on the affinities of the organisms he has studied. In doing so, he assumes further that the individuals showing these resemblances will breed true, and that no two such groups regarded as different will interbreed in Nature in ordinary circumstances. To this conception of closely allied, but different, groups of individuals the name "species" is given. In considering this concept of a species, it must be remembered that a general statement or "law" is true only within certain limits, and that the same organism will behave differently when these limits are exceeded and will acquire new properties and characteristics.

Resemblance presupposes differentiation. The recognition of resemblance follows from the true estimation of the value of differences in characters, and for the purpose of establishing relationships the proper estimation of this value is very important. The value of characters varies according to the group of animals dealt with, what is considered sufficient for establishing a species in one group being considered insufficient in another. The appreciation of this depends on the systematist's experience and on the extent to which data are available. In some groups (*e.g.* trypanosomes) where anatomical data afford no clue for the differentiation of species, the physiological reactions they produce are relied on for specific determination. The variation of the value of characters is a fact that the taxonomist must always bear in mind.

Zoology has from its beginning been an observational science, and even now its purely observational and descriptive aspects have by no means been exhausted. Important conclusions have been derived from observation alone. It is possible to generalise from the observation of a large number of apparent facts, but such generalisations cannot be more than tentative hypotheses, their probable accuracy being proportional to the number of observed facts. It is here that the value of experiment in increasing the proportional accuracy of a hypothesis must be recognised. The observation of an orderly sequence of events in Nature may be considered by some sufficient for a generalisation, but it seems to me that the introduction of a disturbing element in a given series of events must result in giving us a more complete insight into the nature of things. To recognise relationship by the interpretation of structure, physiological reactions and habits of animals, taxonomy would be in a better position if the opinions of the museum zoologist were tested by experiments in development, in breeding, in ecology, and in the habits of the organism. The need for experiment cannot be too strongly emphasised.

Yesterday our astronomy was geocentric; to-day our biology is anthropocentric. Animated Nature has been, and is still, studied and interpreted through human emotions and prejudices, and it is this inability to assume a detached state of mind in studying Nature that is responsible for the lack (as compared with the mathematical sciences) of rigid thinking in biology. It must, however, be admitted that it is easier to maintain an impartial attitude when considering inanimate Nature than is possible in the study of organisms more or less similar to ourselves. We are too apt to regard man as the highest "created" being, superior to all animals, and this view colours most of our observations, especially those of the purely field-naturalist. We have no evidence for supposing that the fair face of Nature exists for the sole pleasure and benefit of man, and until we cultivate the attitude of regarding ourselves as but one kind of organism in the phenomena of life, we cannot hope for careful observations free from personal likes and dislikes. I stress the fallacy of egoism in zoology largely because the systematist has often to depend on the observations of the field-naturalist in his study of the relationships of the animals with which he deals. It is not given to every systematist to be an ecologist or an experimentalist as well, and it is only by the co-operation of untrammelled minds that we can hope for much future progress in biology. S. MAULIK.

Spermatogenesis in Spiders and the Chromosome Hypothesis of Heredity.

REFERRING to several letters which have appeared in NATURE (September 12, October 3, October 17) on the spermatogenesis of spiders, I have now examined the testes of a number of South African spiders, and it is found that the chromatin behaviour and the absolute dimensions of the spermatogonia and spermatocytes may differ extraordinarily in different species, even when these species are not far removed systematically from one another.

In some of the species there is a variable amount of more or less typical spermatogenesis with the formation of spermatocytes by mitosis, but in addition, in all the species investigated by me, there is an extensive production of apparently functional spermatozoa by some form of amitosis, and in certain species typical spermatogenesis appears to be almost entirely absent.