

as mammals act under injury to presume on that account an absence of that degree of unpleasant consciousness which corresponds to the higher animal's pain. One might *à priori*, from difference in structure and in function both, expect wholly different reactions to stimuli or even none at all. Qualitatively as well as quantitatively the reactions of any two genera may differ to any indefinite degree.

Again that relative deficiency of simplicity of neural organs, natural to the low orders, may be and presumably is correlated with a like deficiency in the duration of the sensations represented by these organs. The time of continuance of a sensation occasioned by a momentary stimulation is perhaps determined by the number and extent of something comparable to association-currents running either between different parts of the neural unit or between these units extended spatially, or both. The former of these conditions may be simpler in the lowest orders, and the latter wholly or at least partly lacking. 'Reverberation,' in a word is less, the simpler the nervous organ. Professor Norman expressly noted in most of his experimental reports a period of quiet on the animal subject's part, representing nervous shock. It is a pure presumption to conclude that such a condition is not 'painful' to the animal. In all the higher animals severe pain is essentially asthenic in its effect on the organism. *Limulus*, cited by the writer, shows this especially well, and furthermore presents yet further evidence of painful or destructive sensation in the extreme abdominal flexion, the general concomitant of pain, noted in the experiments. This depressing period being past, and the perhaps only pseudo-individual being by the injury in no way incapacitated for its customary movements (because of lack of coördinating neural mechanism), these movements soon proceed as if nothing had happened, as indeed perhaps nothing had happened to more than an insignificant independent portion of the quondam individual.

Another consideration, quite old but on that account not less reasonable as it seems to the present writer, may be based on the biologic principle that nature does not act by leaps, that continuity is the all-pervading principle of

evolution and so of psychophysical development. Man undoubtedly has consciousness and at times pain; the lowest organism has a minimum, but always some, of both, 'consciousness,' here indicating experience correlate with mechanical function, and 'pain' that sort of disadvantageous experience correlated with injury to the biologic egotism of the individual—very general terms, but therefore the more useful. Between these two zoologic extremes, the maximum and the minimum of developed life, all animal life has place and has accordingly, from this theoretical point of view, some degree or other of what, for want of a better term, is called pain. Each individual in its degree, be it man's degree or the earthworm's, has feeling, from this the philosophical view point, even as it has motion through space or within its organs. Let one who is disposed to deny this say with what genus sensation ends as one looks down the closely crowded scale of life—is it between man and the monkey or between the alligator and the flounder? However large the empirical gap at present between any two genera may be, the problem is not altered, for like biologic principles actuate them all, and strongest of these principles normally is the preservation of the individual. To this end, perhaps, pain developed, and to this end it everywhere, in the long run, works. This proposition is more than a mere speculative presumption, for observation inductively originated it and continually supports it. To get beneath it were to solve at length the great problem of Job, were to go deeper than empirical science can. It is a principle too firmly fixed in the philosophy of biology, so to say, to be shaken by the necessarily wholly negative result of experimentation where the conditions are so far from those of man, the judge.

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PLANT MATERIAL FOR LABORATORY USE IN THE SCHOOLS.

FOR more than a year there has been offered through the Ithaca Botanical Supply Co. plant material suitable for laboratory use in first courses, and for demonstrations of some of the organs and processes which it is rather difficult

for beginning students to prepare. This work was undertaken at my suggestion by some students who were in need of financial assistance in their laudable endeavor to obtain a college education. It was undertaken both for the purpose of affording some aid in this way, and also for the purpose of assisting teachers and schools, especially secondary and normal schools, in the supply of material which is often difficult to obtain.

It should perhaps be stated that neither I, nor the botanical department here, has any official connection with, nor financial interest in, the scheme. At the same time I have taken a lively interest in the work in order to be assured that the material and the preparations should be of the first order. The persons who make the preparations are thoroughly familiar with modern methods and have attained a high degree of skill in preparing them. The permanent slides showing sexual organs and sexual processes in plants of the different groups are excellent and very beautiful. I am quite sure that those who are familiar with good technique will be quite surprised at the high degree of excellence presented in these slides, and certainly they represent the structures in a strikingly accurate manner. They put up in addition to other material, a 'high school set.' Persons or schools desiring further information can obtain a price list by addressing 'The Ithaca Botanical Supply Co.,' Ithaca, N. Y.

GEO. F. ATKINSON.

DO FISHES REMEMBER?

A RECENT paper* by Professor L. Edinger, entitled 'Haben die Fische ein Gedächtniss,' is primarily a statement of the conclusions which its author has reached as a result of his questionnaire, 'Do Fishes Remember?' sent out in 1897. These conclusions are prefaced by some discussion of comparative psychology in general and some account of the sense-powers of fishes. The former is judicious but not new; the latter is convenient though not complete. Dr. Edinger is inclined to accept the decision that fishes do not hear sounds,

though he seems not to know of the experiments of Dr. F. S. Lee, experiments more conclusive than any he reports.

Dr. Edinger's question as to memory is not about the existence of certain feelings of a thing as having been experienced before, but about the possibility of permanent associations, of after-effects of experiences. He asks concerning the fish nervous system, "Is this apparatus capable of in any way preserving impressions made upon it; do there exist after-effects due to previous experiences?" p. 16. Or, in other words, "Can impressions which are new to the animal, gain an influence on its activities; especially can they preserve this influence for a considerable time?" p. 17. He decides in a rather half-hearted way that they can, on the basis of the evidence obtained from the answers to his questionnaire and elsewhere. He summarizes this evidence as follows: "(1) The inborn impulse to flee can be lessened by the animal becoming accustomed to impressions which formerly frightened it, but this tameness is lost if new stimuli enter into the experience. The impulse to flee can also appear in the presence of stimuli which have never been present before. Animals become afraid. By habit the sight of the one who feeds them may take the place of the optical or chemical stimulus which ordinarily leads to the act of feeding" p. 28.

Dr. Edinger's limitation of fishes' powers of forming associations and being influenced by them more or less permanently, to the single cases of tameness, fear and associations between the feeder and feeding, is misleading. It is no characteristic of fishes' mentality to form such habits rather than others. The prominence of such in the answers to the questionnaire is due, not to the mental constitution of the fish, but to the interests of the observers. As a matter of fact the questionnaire proceeding seems a very awkward way of answering the question about the permanent effects of novel experiences. One can, as has been shown in the December number of the *American Naturalist*, get direct evidence of the fact and demonstrate it to a class in the space of five hours.

Although familiarity with animal psychology proper and a bit more ingenuity might have

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