

always met with success. Certain lakes possessing all the obvious biological and physical requirements have been repeatedly planted without result, and it has been but recently determined, through the work of Prof. E. A. Birge, that the failure is due to peculiarities of the gaseous content of the water. In a paper on the gases dissolved in the waters of Wisconsin lakes, Dr. Birge illustrated his studies, which are of the highest value to fish culture.

A paper on the utilisation of sea-mussels and dogfish as food, presented by Dr. Irving A. Field, opened a very general discussion on a subject which appealed to both the biologists and the practical fishermen. During recent years the horned dogfish (*Squalus acanthias*) has been extremely destructive to fish and fishing on the coasts of Canada and New England, while the smooth dogfish (*Mustelus canis*) is a perennial menace to the lobster. In Canada oil and fertiliser works have been established for the purpose of supplying a market and encouraging the destruction of the dogfish, and Prof. Prince is of the opinion that they have to some measure decreased in numbers.

Dr. Field's experiments have demonstrated that the smooth dogfish, salted and dried, makes a product closely resembling the cod, and in a fresh condition it is not inferior to texture and flavour to halibut; the horned dogfish, being more oily, is better adapted for tinning. Mr. Fryer stated that the equally destructive dogfish of the English coasts had been placed on the markets by the fishermen, and while it was unobjectionable as to quality, it met with prejudice on account of its name, a difficulty which also confronts the exploitation of dogfish as food in the United States and Canada. An euphonious name, not deceptive in character, would assist greatly in converting a fishery menace into a valuable product and important source of cheap food supply. The practical difficulties confronting the utilisation of these fish are being made the subject of inquiry by various technical bodies in the United States and Canada.

A communication from the Rhode Island Commission of Inland Fisheries, in reference to the effects of gun-fire on schools of fishes, developed a difference of opinion between the scientific men and the practical fishermen. The latter declared that the heavy detonations from cannon drive the fish away from the coast, but the results of experiments at Woods Hole, as recounted by Dr. Sumner, indicated that mackerel and other surface-living fishes were but little disturbed by either gun-fire or the noises made by boats using explosive engines. The investigations of Dr. Parker at the fisheries laboratory prove that certain fishes are influenced by sound stimuli as distinguished from the grosser mechanical vibrations of the water, but that their sudden movements of alarm are dictated by sight rather than by hearing.

Eighteen corporations and individuals interested in the fisheries offered prizes for contributions on special subjects, and of these seven were unawarded, either because the papers submitted did not satisfy the strict conditions of the award or because they did not conform to the standard of merit imposed by the international jury of awards. Two awards were made to Prof. A. D. Mead for the papers above-mentioned, two to Dr. H. F. Moore for papers on the sponge fisheries and on growing sponges from cuttings, one to Mr. Dwight Franklin for the best method of preparing fishes for museum purposes, one was divided between Dr. F. A. Lucas and Mr. R. W. Minor, for papers on the best plan for an educational exhibit of fishes, one was given to Mr. Chas. H. Stevenson for the paper above alluded to, one to Mr. Paul Reighard for the best plan to promote the white-fish production of the Great Lakes, one to Prof. Jacob Reighard for the best methods of observing the habits and recording the life-histories of fishes, one to Mr. Chas. G. Atkins for a paper on foods for use in rearing young salmonoids, and one to Mr. John J. Solomon for a process for preserving the pearl fisheries and increasing the yield of pearls.

Many papers of much practical and scientific merit were submitted, but not read for lack of time, but they will be published in the proceedings of the congress. The fifth congress will be held in Rome in 1911, the year of the semi-centennial of the Italian Federation.

NO. 2039, VOL. 79]

PSYCHOLOGY OF PLEASURE AND PAIN.

THE last two numbers of the *Psychological Review* (July and September) have contained important articles by Prof. Max Meyer, of the University of Missouri, on the nervous correlate of pleasantness and unpleasantness. In the former the author brings out the contradictory character of the present views of psychologists on this subject, and in the latter proposes a theory that he believes accords with all known facts and gives proportionate weight to the various aspects of the question upon which his predecessors have dwelt too exclusively. The clearest opposition has hitherto been between the psychologists, who hold that pleasantness and unpleasantness are merely weak (and therefore badly localised or entirely unlocalised) forms of the sensations, which at a higher degree of intensity become respectively sexual sensation and pain, and those who, denying their substantive status, regard them merely as aspects or "tones" of sensational processes.

Prof. Meyer's theory is of a different type altogether, and is based upon the concept of an hierarchy of reflex arcs or a "centralisation by degrees." Let A and B be two sensori-motor systems of neurons relatively independent, but having at least one connecting neuron in common. It is always possible for these to merge into a more complex sensori-motor system, C. The marks of this higher organisation will be (1) that stimulation of a sensory point of either A or B may produce simultaneous reactions at motor points both of A and B; and (2) that simultaneous stimulation of sensory points of both A and B may produce a reaction at a motor point of A or B only. In the case of such a system, if the subsystem A is functioning a strong stimulation of subsystem B will produce a decrease in the intensity of the current in A (drawing it off, in fact, towards motor points of B), while a gentle stimulation of B will merely increase the current setting towards motor points of A. The decrease or increase in the flow through system A, due to the action of B, is the nervous event which will be experienced as unpleasantness or pleasantness respectively. For example, the slight degree of pain produced by scratching after an insect's bite is rather pleasant, for it actually increases the energy of the scratching process. If, however, the pain becomes too intense, its own typical reaction is set up; energy is drawn off from the scratching process, and unpleasantness is felt.

It follows on this theory that pleasantness and unpleasantness are attributes of the relatively more complex psychophysical functions, and, therefore, that their highest intensity may be expected to accompany intellectual activity—a result which the author claims as a powerful piece of evidence of the superiority of his doctrine over that which would regard them as "feeling tones" of sensations.

SCIENTIFIC EDUCATION OF NAVAL ARCHITECTS.¹

IT has occurred to me that an appropriate subject for the address, which it is my duty to deliver as chairman of the council, may be found in a brief account of the methods adopted for the education of naval architects in this country during the past century. I venture to hope that, apart from its particular interest for those engaged in shipbuilding, the narrative may have some value and attraction for those interested in technical education generally, and that it may throw some light on problems of higher technical education which still await solution in this country.

In 1806 the Commission of Naval Revision reported in regard to the principal shipbuilding officers of the Royal Navy. There is evidence that outside the Admiralty service the standard of professional attainment amongst British shipbuilders was then low. As practical ship-carpenters they excelled; their ships were "well and truly built," strong and durable. As ship-designers they depended on

¹ From an address delivered before the Society of Arts on November 18 by Sir W. H. White, K.C.B., F.R.S., chairman of the Council of the Society.