

the hermaphroditic condition since a complete return to the diœcious condition normal to the species results in the first sexual generation.

It will be of interest to see how closely the further discoveries in the mosses follow the conditions worked out in such an unrelated form as *Phycomyces*.

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#### A STUDY OF VISUAL FIXATION

PROFESSOR RAYMOND DODGE begins a series of "Studies from the Psychological Laboratory of Wesleyan University" with "An Experimental Study of Visual Fixation." The *Psychological Review* prints the number as its Monograph Supplement for November, 1907.

Professor Dodge finds that the involuntary movements of the eyes during supposed fixation are, in part, compensatory to head and body movements; in part, however, they are "normal and physical disturbances" of fixation, due to irregular head and body movements for which compensation is inadequate. The compensatory eye movements are united with the movements of head and body "into a thoroughly organized motor system," furnishing a coordinating mechanism capable of "explaining the intimate correspondence between tactual and visual space." Visual motives for the fixation movements are found in retinal fatigue and in the correction of inadequate binocular coordination.

In studying control of fixation movements, Professor Dodge remeasured the ocular reaction time, using Professor Holt's method with the alternating arc light, the fall of the exposure screen giving the stimulus simultaneously with the actinic beam, the latter being reflected from the cornea to the falling plate of the camera. The alternations of the current thus gave a time record in a series of dots. Interruptions by a tuning-fork would give greater accuracy. Plates of pot blue glass "stopped down" the arc light to a comfortable glow without materially reducing the effect on the camera plate. The slow reaction time determined by earlier experimenters

was confirmed, but a minimum of 130  $\sigma$  was reached. The head reaction was quicker than that of the eye.

Successive fixations of the same word were found to vary widely in location of the point of regard, but were called "perfect fixations" when the object of interest was "brought to a retinal area of clear vision." The functional center of the retina is larger or smaller according to the character of the object and according to the corresponding extent of the area of clear vision.

Fixation is called "adequate" when it is sufficiently long and accurate to condition a "cleared-up" perception of the object of regard. Renewing his criticism of the short exposure-times of Zeitler and Messmer, Professor Dodge measures the exposure-time needed for the "clearing up" of words presented upon various pre- and post-exposure fields, and concludes that "the shortest adequate fixation pauses in reading are between 70  $\sigma$  and 100  $\sigma$ ."

In further experiments he measured the effect of peripheral factors, such as words seen peripherally in reading, in modifying the total consciousness without properly "clearing up." The movement is from general to special effects, phrase, sentence and paragraph, episode and plot, forming "a dynamic background" for each new word-complex as it clears up.

Professor Dodge raises the question whether the spatial relations of the total visual field are determined by its relations to the fovea, or whether the object of regard is not "rather determined in its spatial relations by its apparent position in the total visual field"; and after criticism of the theory of retinal local signs, he proposes a substitute theory of "genetic organization of the retinal elements." While the argument here is not wholly satisfying, the new facts that are being brought forward in this field make it certain that a better theory is to shake out eventually, and Professor Dodge's view is worth a careful reading.

The appendix to the article reviews the technique of recording the eye-movements by photographic registration, and describes the apparatus used in the Wesleyan experiments.

By some unaccountable error Professor Dodge represents the foveal and macular fields of regard as less than one fifth their actual size, as calculated by the present writer upon data given by Helmholtz and Kölliker. While the author was evidently influenced by this mistaken notion of the relation between the central and peripheral fields, his main contentions are probably not invalidated by the error. The failure to state the reading distance, in his measurements of the effects of peripheral stimulation upon speech reactions, greatly lessens the value of these data to other experimenters.

In spite of errors, however, the article's positive contribution is important, and there are several clever minor experiments which deserve recognition did space permit.

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#### SCIENTIFIC JOURNALS AND ARTICLES

*The Zoological Bulletin* of the Pennsylvania Department of Agriculture for December, 1907, is devoted to the lizards of Pennsylvania, a somewhat brief topic, since only five species occur in the state. Besides the keys to genera and species, and detailed descriptions, there is a study of the food, based on the examination of as many stomachs as were available. The showing is favorable to the lizards as friends of the farmer. The paper is prefaced by a discussion of lizards reported in the human stomach, and it is hoped that this may do something to counteract the very common belief that such cases actually occur.

*The Museums Journal* of Great Britain for January has a good paper, by H. C. Sorby, "On the Preservation of Marine Animals with their Natural Color." The best results were obtained by the use of anhydrous glycerine, in some instances a layer of almond oil being placed on the top of the glycerine. Sponges, sundry worms, mollusks and fishes subjected to this treatment retained their colors perfectly at the end of seven years. Alex. Hutcheson describes "An Early Dundee Museum," and O. Gylling, in reply to a criticism by Mr.

Bather, explains that the unpleasant features of certain groups in the Malmo Museum are due to the principle of showing the animals in characteristic situations, or when displayed in traps, as an incident of their extensive utilization by man. The balance of the number is devoted to reviews and notes. Among these last is one in which Professor Ray Lankester attacks "Newspaper Natural History" with a seriousness that raises a smile. Incidentally, Professor Lankester commits an error himself in saying that "*Elephas columbi* and the mammoth are as nearly as possible of the same size," for *E. columbi* stood a foot to eighteen inches taller than his northern relative.

*The Bulletin of the Charleston Museum* for March gives a "Synopsis of the Bird Records of the Natural History Society for the Year 1907."

*The Museum News* of the Brooklyn Institute is mainly devoted to articles on the libraries of the Central and Children's Museums. The former is a reference library of art, ethnology and natural history, the latter is somewhat unique, for, in addition to being for the use of the staff, it acts as a school reference library for teachers and pupils, endeavors to supply information to the general public, and seeks to interest school children in the various subjects included in the scope of the museum.

THE Free Public Library of New Bedford has just issued a catalogue of its "Collection of Books, Pamphlets, Log Books, Pictures, etc., illustrating the Whale Fishery." It is particularly rich in log books, and these should contain much information regarding the distribution and former abundance of whales. The collection has been largely increased since the issue of the catalogue.

THE contents of the December issue of *Terrestrial Magnetism and Atmospheric Electricity* are as follows:

Portrait of Maurits Snellen—Frontispiece.

"The Penetrating Radiation," by W. W. Strong.

"Helwan Magnetic Observatory, Egypt," by B. F. E. Keeling.

"Results of Magnetic Observations made by the United States Coast and Geodetic Survey at the