growth, development, physiology of respiration and digestion, his excellent summary of the principal investigations on the determination of age by means of the ootoliths, scales, opercular bones and vertebræ, and lastly, in a few pages relating directly to fish culture.

A summary of the important literature is given under each heading, emphasis being laid quite naturally upon European publications. This feature together with a full bibliography will be especially helpful to American students. The consideration of all recent experimentation and the judicious application of the principles set forth is a most commendable characteristic of the whole work.

G. C. Embody

*The Care of Home Aquaria.* By Raymond C. Osburn.

This contribution of Professor Osburn's, published by the New York Zoological Society as a volume of the New York Aquarium Nature Series, on account of its small size and necessarily popular character, is too likely to be overlooked. The investigator of any form of aquatic life will find aquaria of the utmost service, and will do well to refer to this simple presentation of the fundamental principles which govern their care. Under the captions The Meaning of Balance, Temperature, Placing and Cleaning the Aquarium, Animals that Will Live Well Together, Feeding, Marine Aquaria, The Care of Young Fishes, etc., a great deal of broad, practical information will be found arranged. Ample illustrations are attractive rather than instructive. A short appended bibliography will be found useful.

The following paragraphs are quoted more or less at random:

"The fact that animals require oxygen in respiration and that green plants give off oxygen in excess were discovered and published as early as 1778, but lovers of aquatic life were slow to apply this knowledge. In fact, it was not until 1850 that the first properly balanced aquarium was described by Mr. Robert Warrington of Manchester, England."

"To supplement the surface absorption of oxygen, it is necessary to grow plants in the aquarium."

"It is a common but very mistaken notion that an animal should have food at hand at all times to keep it in good condition. It is well known that various forms of domestic animals, as well as the wild species confined in zoological gardens, make the best growth and keep in the most satisfactory condition when supplied only with what food they will clean up at one feeding. This applies with equal force to the inhabitants of the aquarium, but besides *there is a real and grave danger of contaminating the water by supplying more food than will be readily consumed.*"

Emphasis is placed on the great educational value of aquaria. The ordinary balanced aquarium is a little world apart, in which plants, fishes and microorganisms are mutually interdependent, and the art of aquarium-culture is to understand and control this balance.

John Treadwell Nichols

*Animal Flight, A Record of Observation.* By E. H. Hankin. London, Iliffe and Sons, Ltd. 8vo. Pp. 413, 97 figures.

Considering the many explanations we have had of soaring flight, it is somewhat surprising that we know so little about it and that still further explanations seem necessary. The author of the book under consideration takes care to state in the preface that "the present book will be found to contain the facts in the case, with no explanation at all," a statement that seems at once to claim too much and too little.

Until he has watched and recorded the frigate bird and the albatross a large portion of the facts must be considered as lacking, while running through the record of the author's observations is an evident, though unexpressed, belief that some occult influence is at the bottom of it all.

The observations, for the most part, were made at Agra, India, and the majority of them on the kite, or cheel, *Milvus govinda,* though they include the adjutant and three species of vulture, all experts in soaring.

Special consideration is given to what the author terms the soarability of air, the condition that enables it to furnish energy for soaring flight, and the state of the weather as to sun, shade, wind, heat or cold are carefully recorded, as well as the time of day at which birds begin to soar. Soarability is believed to be brought about either by the sun or the wind, and sun soarability is stated to occur at a fairly definite time of day, varying naturally with the season. Here we are reminded of Mouillard's observations on griffon vultures in Algeria and his similar statement that they do not begin to sail until the sun is well above the horizon. The author seems inclined to have at first considered that there was a direct connection between heat eddies, indicating rising currents of air, and soarability, but later decided that this was not the case. And yet the curve showing time of appearance of heat eddies for a month coincides absolutely with the time of sun soarability.

Readers may recall, though Dr. Hankin does not mention it, the theory that soaring is effected by ascending currents of air impinging on the curved, though very minute, barbules of feathers. Wind soarability is believed to be due to some inherent property of the air and not to mere velocity, and throughout the book one notes the author's evident feeling that birds, flying fishes and dragon flies obtain energy from the air in some occult, or at least unknown way. Occult it does seem, to any one who has watched an albatross gliding into the eye of the wind or tacking back and forth, perfectly at ease in a driving gale. Wonderful it certainly is in view of the infinitesimal expenditure of muscular energy, but, remembering Langley's memoirs on the internal work of the wind and the strong and varied eddies that he showed might be present in an apparently steady breeze, one feels that birds with their thousands of years of experience and automatic adjustment to every air current can derive sailing energy from, to us, invisible sources.

Great attention is paid to the use of the wings and tail, and careful records are given of their varied motions, positions and relative angles to the body in directing, accelerating or checking flight; all of which are most valuable.

An extremely interesting chapter is devoted to the Flight of Flying Fishes, containing carefully-made and well-recorded observations of the character of their flight and the conditions under which it is made. The conclusion reached is the same as that of Colonel Durnford, that they do actually fly, and that initial impulse is utterly inadequate to account for the long distances covered, the sustained speed and ability to change direction when on the wing.

We are introduced to a considerable number of new words, or new meanings, such as soarability, flex-gliding, tail-jolting, and while at first sight these seemed unnecessary, yet on further perusal one was forced to admit that they conduced to brevity and clarity of statement. Lexicographers will find these new words and terms carefully defined in a glossary and will duly thank Dr. Hankin for his thoughtfulness and commend it to future coiners of words.

F. A. L.

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## *RECENT STUDIES IN ANIMAL PIGMENTATION*

MUCH has been written on animal pigmentation from both the biological and the chemical standpoint, but the views regarding the nature and origin of pigment are still at variance. Perhaps the chemists have made most progress in determining the chemical nature and composition of animal pigment, especially of that form known under the name of melanin, which occurs either normally or pathologically in the animal body, hair or feathers. Dr. Ross A. Gortner, of the Cold Spring Harbor Station for Experimental Evolution, who has devoted a number of years to this subject, states that the black humic substances, known as artificial melanin or "melanotic substances," resulting from the hydrolysis of proteins by strong mineral acids, or the dark products formed by the action of oxydases upon aromatic or heterocylic phenols may sometimes be shown to be related to the melanins, but until that relationship is demon-