

originally coincident, and through changed conditions have diverged, forcing migration from one to the other. The climatic changes of the glacial epochs and the extension of range of species have been suggested as primary influences to this end, while the suggestion has also been made that migration may have arisen suddenly from abrupt movements such as still occur in certain species today. All of these theories are, however, in Dr. Thomson's opinion, beset with difficulties and they do not explain the nature of the inborn custom nor the manner of its inheritance.

3. What is the stimulus that puts migration in action at the proper time twice a year? This necessary stimulus has been sought in physiological changes connected with the recurrence of the reproductive season and also in external climatic conditions. Our author suggests that both may be operative, the former predominating in spring and the latter in autumn although climatic changes may again and again stimulate migration after a physiological stimulus has produced the necessary condition of unrest, thus causing the successive advances in spring.

4. The last problem is the *modus operandi* of the actual migratory performance; what determines the routes and how do the birds follow them? Dr. Thomson thinks that there must be some inherited memory of path and goal and contends that the knowledge cannot be traditional since young birds migrate for the first time unguided. Vision he regards as an important point although he admits it may seem inadequate in over-sea paths, and we surely think it is. He considers that the term a "special sense of direction" is devoid of exact meaning, which is very true except it denote a faculty that wild animals have that we cannot yet describe in terms of the known senses. He moreover feels that the homing of pigeons and other birds removed to distant points artificially "is not strictly analagous to migration but raises some points of difficulty."

We may not agree with his estimates of some of the theories that have been advanced but here again we must point out that he is merely weighing them in accordance with their value in the study of behavior and giving us what he regards as a working hypothesis for future studies.

When we read his admirable work we realize the complexity of the subject and the amount of knowledge that we should possess of the work of our predecessors before we are justified in entering upon the field of speculation and theory. If bird banders hope to advance beyond the stage of putting bands on birds' legs, or recorders of bird arrivals wish to understand the significance of what they are doing, they should read this book and gain some clear idea of the magnitude of the problem they are attacking.—W.S.

**Heilmann on 'The Origin of Birds.'**—This important work<sup>1</sup> consists of a compilation of all the data so far presented bearing upon the ancestry

<sup>1</sup> *The Origin of Birds.* By Gerhard Heilmann. With two plates in colour and one hundred and forty photographs and text-figures from drawings by the author. London, H. F. & G. Witherby, 326 High Holborn, W. C. 1926. pp. 1-208. Price 20s. net.

of birds with much discussion of their reptilian relationships, and the author's conclusions on the subject. His researches have been exhaustive and his success in digesting and presenting in readable form a resumé of such varied publications is remarkable, especially when we realize that Dr. Heilmann is a Dane writing his treatise in English.

He divides his work into four parts: In Part I he considers "Some Fossil Birds," first *Archaeornis* and *Archaeopteryx* and then *Ichthyornis* and *Hesperornis*. He has studied exhaustively the specimen of *Archaeornis* in the Berlin Museum and given us a colored restoration of it as a frontispiece to his book as well as one of the Loon-like *Hesperornis*, and his graphic pen pictures of the life of these birds respectively in the tree fern forests of the Jurassic and in the Cretaceous seas, and their conflicts with their reptilian contemporaries is vivid indeed. He also by means of numerous original drawings and photographs shows us the close correspondence in the skeletal structures of reptiles and birds. Part II discusses the embryonic stages of birds and reptiles and sketches the development of the skeleton in the two groups.

Part III consists of "Some Anatomical and Biological Data" in which are considered the supra-temporal fenestra, digital claws, cerebrum and cerebellum, organs of sense, sexual organs and secondary sexual characters in birds and reptiles.

Taken together the data presented in these three parts serve to demonstrate the close relationship between birds and reptiles and the certainty of their common ancestry, preparing us for Part IV in which Dr. Heilmann seeks for the group of reptiles from which the birds probably sprung, *i.e.*, the "Proavian." This he considers is found in the *Pseudosuchia* a group of fossil reptiles less specialized than the Dinosaurs. Some of these had evidently developed into terrestrial runners with the fore part of the body elevated from the ground and from these arose arboreal climbers from which was evolved the *Archaeornis* and eventually the modern birds.

The resemblances of the Pterodactyls to birds he considers merely superficial and the claims advanced for *Iguanodon* and certain other types as the direct avian ancestor are disposed of. The many sketches of restorations give the reader a much clearer idea of these various early types than is possible in a description, and for those who wish to follow the subject further the excellent bibliographies, often accompanied by synopses, are a great help.

Dr. Heilmann is to be congratulated upon producing a book at once interesting to the scientific investigator and yet understandable by the layman desirous of getting some knowledge of this interesting problem.  
—W. S.

**Wetmore on Patagonian Birds.**—While engaged in working up his collection from Argentina and the adjoining countries Dr. Wetmore worked up a collection of Patagonian birds obtained by Mr. J. R. Pemberton, while engaged in geological work from 1911 to 1915, and presented to the Museum