which otherwise would be liable to alteration by the varying conditions to which by reason of its peculiar mode of life the animal is so much exposed.

Passing now from the anatomy of the Spheniscidæ, there are certain points to which, although not directly connected with the special subject of this memoir, attention may as well be directed in connection with the group of birds under consideration.

The mode of locomotion of the Penguins, both upon land and in water, is noteworthy. The peculiarly upright position of the birds when on land has formed the subject of remark of every traveller who has seen these birds in their native haunts, and has been frequently referred to in the preceding pages in connection with the anatomical arrangements which are correlated with it. One other peculiarity may be insisted upon in this connection. The position of the tarso-metatarsus of the Penguins is, so far as I am aware, peculiar among birds.[1] In all other birds, during terrestrial locomotion, the tarso-metatarsus is elevated so that only its distal extremity comes into relation with the ground, whereas in the Penguins the whole length of this bone is applied to the ground, the "heel" of the foot, physiologically considered, in the case of other birds being situated at the distal extremity of the tarso-metatarsus, while in the Spheniscidæ it is formed by the proximal end of that bone. In accordance with this arrangement, we find that while in the majority of birds the metatarso-phalangeal articulations admit of great mobility, in the Spheniscidæ, on the other hand, these joints are relatively stiff, and greater freedom of movement is permitted at the intertarsal articulation or ankle joint. May we not regard this plantigrade condition of the foot of the Penguin as a survival of a similar feature in the anatomy of the ornithoscelidan ancestors of the Spheniscidæ?

With regard to the method of locomotion of the Penguins in water, attention has been already directed to the peculiar mode of action of the wings as organs of propulsion, and to the corresponding alterations in structure of these organs from that of the typical avian extremity. The wing as a whole is freely moveable at the shoulder joint, but the more distally placed joints are relatively fixed. Thus the wing is converted into a paddle, well adapted to the necessities of the Penguin. The wing in many other aquatic birds is similarly used to enable the animal to propel itself through the water, but in none does the organ manifest the striking adaptation to this function that it does in the Penguins, chiefly on account of the fact that while in other diving birds the wing is used not only as an organ of aquatic but also of aerial progression, whereas in the Penguins its function is exclusively that of the former.

In the majority if not in all the truly aquatic and diving birds, with the exception of the Spheniscidæ, the legs come into play as accessory propulsive organs when the bird is diving. In this respect the Spheniscidæ differ essentially from those other birds which in

[1] Attention was first directed to this peculiarity by C. Geoffroy, Note sur les Manchots, Bulletin de Sciences par la Societé Philomathique, Paris, 1798, vol. i. p. 81.