STUDIES ON THE INCUBATION STRIPS OF PENGUINS

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Ecological, morphological, anatomical and histological studies were made on the incubation strips of five species of penguins, i.e. emperor p. (*Aptenodytes excelsior*), king p. (*A. patagonica*), bearded p. (*Pygoscelis antarctica*), Adelie p. (*P. adeliae*) and Humboldt p. (*Spheniscus humboldti*). Twenty-nine individuals in all were studied. The following results were obtained.

1) Unlike those of other birds the incubation strips of the penguins are congenitally devoid of feathers and down. Furthermore the opening and closing movements of this organ are seen only in penguins, and are especially remarkable in the genus *Aptenodytes*.

2) The incubation strip is a specially developed organ which shows opening and closing movements in a voluntary manner and is mainly governed by four muscles, i.e. M. pectoralis major abdominis avis, M. abdominis incubationis, the abdominal head of M. semimembranosus and M. transverso ani anterior.

3) It was suggested that the incubation strip might play an important role in body temperature control during the summer period in addition to its function as a brooding organ.

4) Especially in the genus *Aptenodytes*, the incubation strip has phylogenetically developed into an incubation sack which enfolds the egg. It was conjectured that this enfolding might increase the efficiency of brooding during the coldest season in the antarctic.

5) The size of the incubation strip is extremely large in the emperor p. in which the opening and closing movements of the organ were remarkable and were recorded cinematographically by the author. In the Humboldt p. the actual size as well as the movements of the organ are much smaller than in the emperor p. However, the relative size of the incubation strip in the Humboldt p. was invariably larger for its body weight as compared with emperor p. This might be an inherent difference between the two species.

6) It seems appropriate to regard the abdominal featherless area of the skin in penguins as a specially differentiated type of brood patches seen in varieties of birds and to refer to the same as an "incubation strip" as suggested by FARNER in 1958.