

function, the bladder has either disappeared functionally or has become greatly modified to meet the new requirements. The probable mode of origin of the type of air-bladder found in *Anabas* and *Ophicephalus* is discussed below.

The extension of the air-bladder in the caudal region among the *Anabantidae* and the *Ophicephalidae* is a remarkable morphological feature of these fishes. It has been indicated above that they are provided with extensive chambers in the head region for storing air for respiration and, in spite of these buoyant structures at the anterior end, they spend most of their time lying horizontally at the bottom. To reconcile these two facts, one has to imagine a type of fish before the development of the air-

§ *Clarias* and *Heteropneustes* (= *Saccobranhus*) are generally regarded as mud-inhabiting fishes of India. Though capable of living in mud when the water dries up, they are by no means mud-fishes, for they keep floating in water, usually near the bottom. It was under a misapprehension, therefore, that I (*Proc. 17th Ind. Sci. Cong.*, 1930, 229-243) attributed the reduction of the air-bladder in these fishes to a ground habit of life. The most plausible reason for the reduction of the bladder is to be found in the development of air-chambers and the floating habit of these fishes.

These observations show how identical modifications sometimes result from widely different causes, and, in consequence, the great need of field observations in the study of adaptations—correlation of form and habits. Cases are known of divergent modifications under similar environmental conditions (Hora, *Phil. Trans. Roy. Soc. London* (B), 1930 a, 218, 266), and in the case of the reduction of air-bladder in fishes similar modifications have resulted from different causes. The result in all cases is the adjustment of an organism to the external conditions of its existence.

chambers. In an ordinary fish, the air-bladder is situated in the abdominal cavity and the fish is enabled to move up and down or lie at the bottom without feeling inconvenienced. The ancestors of the *Anabantidae* and the *Ophicephalidae* were probably bottom fishes. When they developed the habit of breathing air and storing it in cavities in the head, the anterior end became buoyant, so, for bottom life, they had to spend a great deal of energy to keep the front end down. Thus, such a fish had to swim almost constantly with the head directed downwards and the body inclined at an angle. Under these circumstances, the air in the air-bladder began to exert some pressure on the neighbouring ventral muscles of the caudal region which gave way and enabled the extension of the bladder backwards. This process must have continued for some time, till the buoyant tendencies of the anterior part of the fish were balanced by the extension of the bladder right up to the base of the caudal fin and it could lie at the bottom without any exertion.

The origin of the air tubes of *Heteropneustes* and of the air-bladder in fishes has to be traced to a similar habit. In the beginning, these structures probably developed as small pouches for storing air in the head region and when the anterior end became buoyant and the fish had to struggle for lying at the bottom, the backward extension of these pouches resulted in the setting up of the proper equilibrium. These observations lend support to the view that air-bladder probably developed as an organ of aerial respiration and that its present hydrostatic function is only a secondary acquisition.

Institute of Oil Technology, Nagpur.

THE Committee appointed by the Nagpur University in April 1933 to investigate the economic potentialities of the development of Oil Technology in Central Provinces and Berar, have recently issued their Report. The Committee recommend the establishment of an Institute at a capital cost of 3.5 lakhs of Rupees and an annual recurring expenditure of 51,000 Rupees. The Institute will provide a three-year course leading to the B.Sc. Degree in Technology and a one-year course leading to the M.Sc. Degree. Provision is made for 36 under-graduate and 12 post-graduate students. The course

of study includes Chemical Technology and Engineering, Physics and Mathematics bearing on engineering problems, commercial economics, accountancy and industrial administration. Plants for the manufacture of soaps, candles, paints and varnishes will be erected so as to afford training of a semi-commercial character to students. If run on commercial basis, the plant is expected to pay its own way. It is hoped that with the help of the Lakshminarayan Bequest, the University will soon be able to establish the Institute.