SOME QUANTITATIVE OBSERVATIONS ON THE BRAIN OF THE CAT-FISH, *HETEROPNEUSTES FOSSILIS* (BLOCH.)

THOUGH considerable literature has accumulated on the anatomy of fish brain[1], the information on the morphometric and allometric aspects has been rather limited[2-4]. The present investigation was undertaken with a view to analysing the intraspecific relationships between the length/weight of the brain, brain/body lengths and brain/body weights of *Heteropneustes fossilis* (Bloch.), a common freshwater cat-fish. Such quantitative study would be useful in analysing the absolute and relative growth characteristics of teleostean brain as also in working out the degree of interspecific variations in the established relationships.

Fishes of the size range 125 to 205 mm were obtained from the fish market. After recording the total body length and weight, the brain of each specimen was taken out, weighed and its length accurately measured. In all, 72 fishes were examined. The various relationships were expressed through regression equations, using methods of calculations as given by Snedecor[5].

Growth in the body length of the fish was found to be accompanied by an increase in the length of the brain (Fig. 1 A). This was found to be a constant feature in fishes of all the size ranges investigated. This relationship was expressed by the equation :

$$\text{Log } x_1 = 0{\cdot}9548 + 0{\cdot}9944 \log y_1$$

Where, x_1 was the body length of the fish (mm), and y_1 was the length of the brain (mm).

The correlation coefficient (r_1) for this relationship was found to be $0{\cdot}298 \pm 0{\cdot}344$, significant at 10% level ($P > 0{\cdot}10$), $Z = 0{\cdot}3$.

Further, increase in the body weight of the fish seemed to maintain a straightline relationship with the increase in the weight of the brain (Fig. 1 B). This relationship could be expressed by the following logarithmic equation :

$$\text{Log } x_2 = 0{\cdot}0207 + 1{\cdot}5469 \log y_2$$

where, x_2 was the body weight of the fish (mg), and y_2 was the weight of the brain (mg).

The coefficient of correlation, r_2 ($0{\cdot}670 \pm 0{\cdot}209$) was significant at 1% level ($P > 0{\cdot}01$), $Z = 0{\cdot}8$.

The regression equation establishing the length/weight relationship of the brain was computed to be

$$\text{Log } x_3 = 0{\cdot}0856 + 0{\cdot}4765 \log y_3$$

where, x_3 was the length of the brain (mm), and y_3 was the weight of the brain (mg).

The above relationship has been shown in Fig. 1 C. The correlation coefficient (r_3) for the same was calculated as $0{\cdot}886 \pm 0{\cdot}080$. Using the distribution of 't' as a measure of probability, r_3 was found to be significant at 1% level ($P > 0{\cdot}01$), $Z = 1{\cdot}4$.

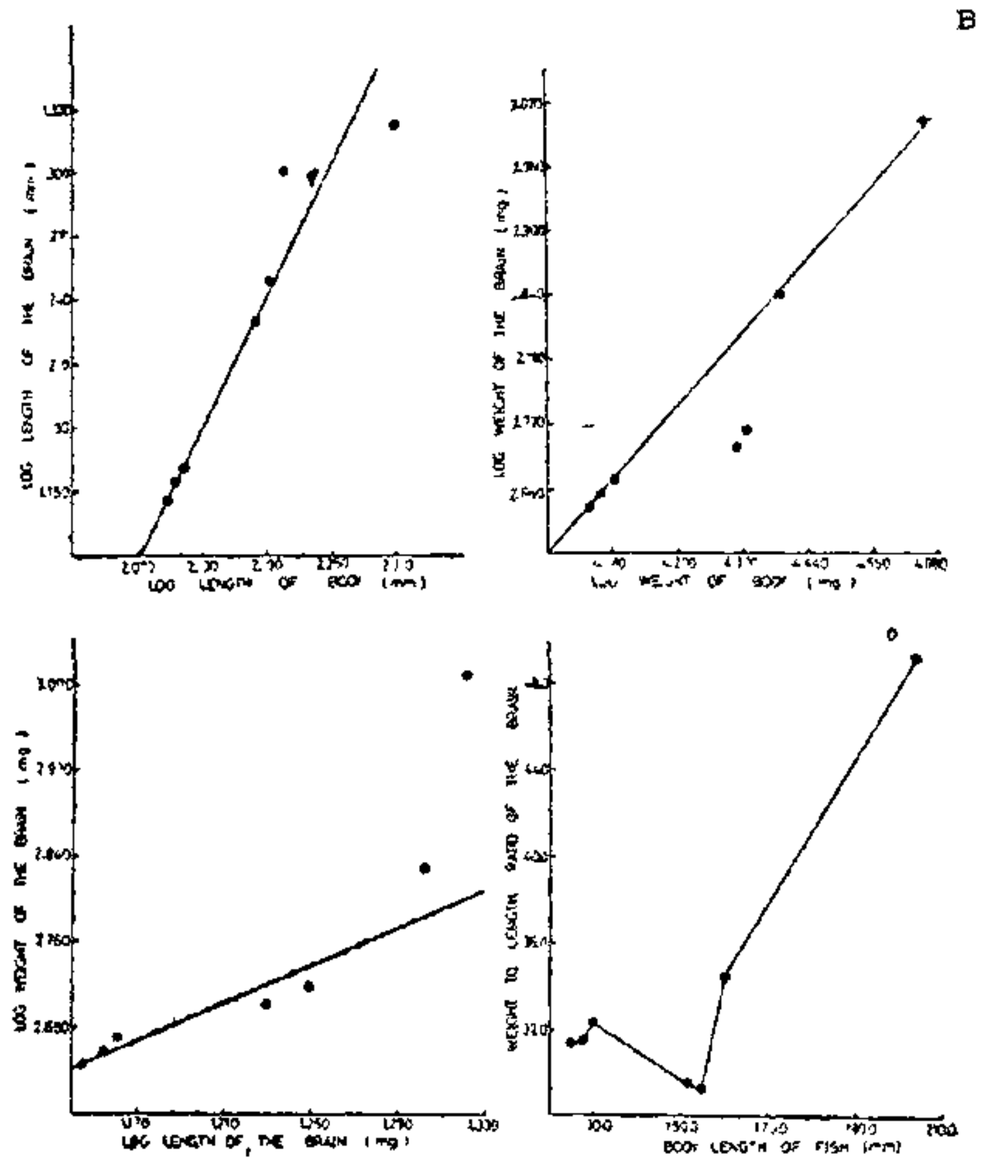

FIG. 1

The growth in the weight of the brain, however, did not proceed uniformly with increase in its length. This was evident from the variations in the weight to length ratio of the brain (Fig. 1 D). This ratio was found to be specific for the different size-groups of *H. fossilis*. In the fishes for the sizes investigated the ratio seemed to rise steadily from 31·4 to 32·4 as the body length increased from 125 to 130 mm. Further increase in the size of the fish was characterized by a decline in this ratio to 29·2 in the specimens of 155 mm size-group. In the larger size-groups, however, the weight of length ratio was again found to rise, indicating that the growth in the weight of the brain continued to occur even when the growth in the brain length, and so also the body length, considerably slowed down.

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1. Bernstein, J. J., In : *Fish Physiology* (Hoar, W. S. and Randall, D. J., Eds.), Academic Press, London and New York, 1970.
2. Bauchot, R., Platel, R., Ridet, J. and Thireau, M., *Acta Zoologica*, 1973, 54, 53.
3. Geiger, W. Von, *Acta Anat.*, 1956, 26, 121.
4. —, *Ibid.*, 1956, 27, 324.
5. Snedecov, G. W., *Statistical Methods*, The Iowa State College Press, Iowa, 1955.

ULTRASTRUCTURE OF FLAGELLA OF SPERMATOZOIDS OF *LYGODIUM FLEXUOSUM* (L.) SW.

FINE structure of the flagella of spermatozoids of various plants and plant groups, *viz.*, *Stigeoclonium*[4], *Polytrichum*[7], *Marchantia*[1,2], *Marsilea*[8], and *Zamia*[5,6] has been investigated in detail. Our investigations on the ultrastructure of the flagella of spermatozoids of *L. flexuosum* have brought out certain new facts in the flagellar construction of the fern spermatozoids which are reported here.

Spores of *L. flexuosum* were collected from the garden of Botany Department, Lucknow University, and were sown under sterile conditions in 1% Knop's solution. The temperature of the culture remained at $24 \pm 2°$ C with light intensity at 600 ft. c.

Spores, germinated on the 4th or the 5th day, though antheridia began to develop after 70 to 80 days. Gametophytes with mature antheridia ready to discharge spermatozoids were fixed in Caulfield's[3] fixative at 4° C for 4 hours. After dehydration, the prothalii were embeded in plastic mixture of Epon and Araldite and ultrathin section were cut on LKB ultratome III, using glass knives. Silver grey colour sections were picked on uncoated copper grids. Sections were stained in lead citrate and uranyl acetate and examined under Hitachi electron microscope Hu-11 E at 75 kV. Photographs were taken on Fuiji electron microscopic film.

The micrographs of the spermatozoids pass through the region where flagella are attached to Vierergruppe. A giant mitochondrion (M) having numerous cristae in very close association of the Vierergruppe as well as numerous flegella cut transversely (Fig. 1) can also be seen in cross-section.

Interesting features of the flegella as seen in the cross-section of the median portion is that the outer membrane has sharp projections and is star shaped (Fig. 2). This differs from the findings of earlier workers who noticed smooth outer membrane for the flagella. However, basal part of the flagellum has smooth outer wall (Fig. 2 shown by arrow).

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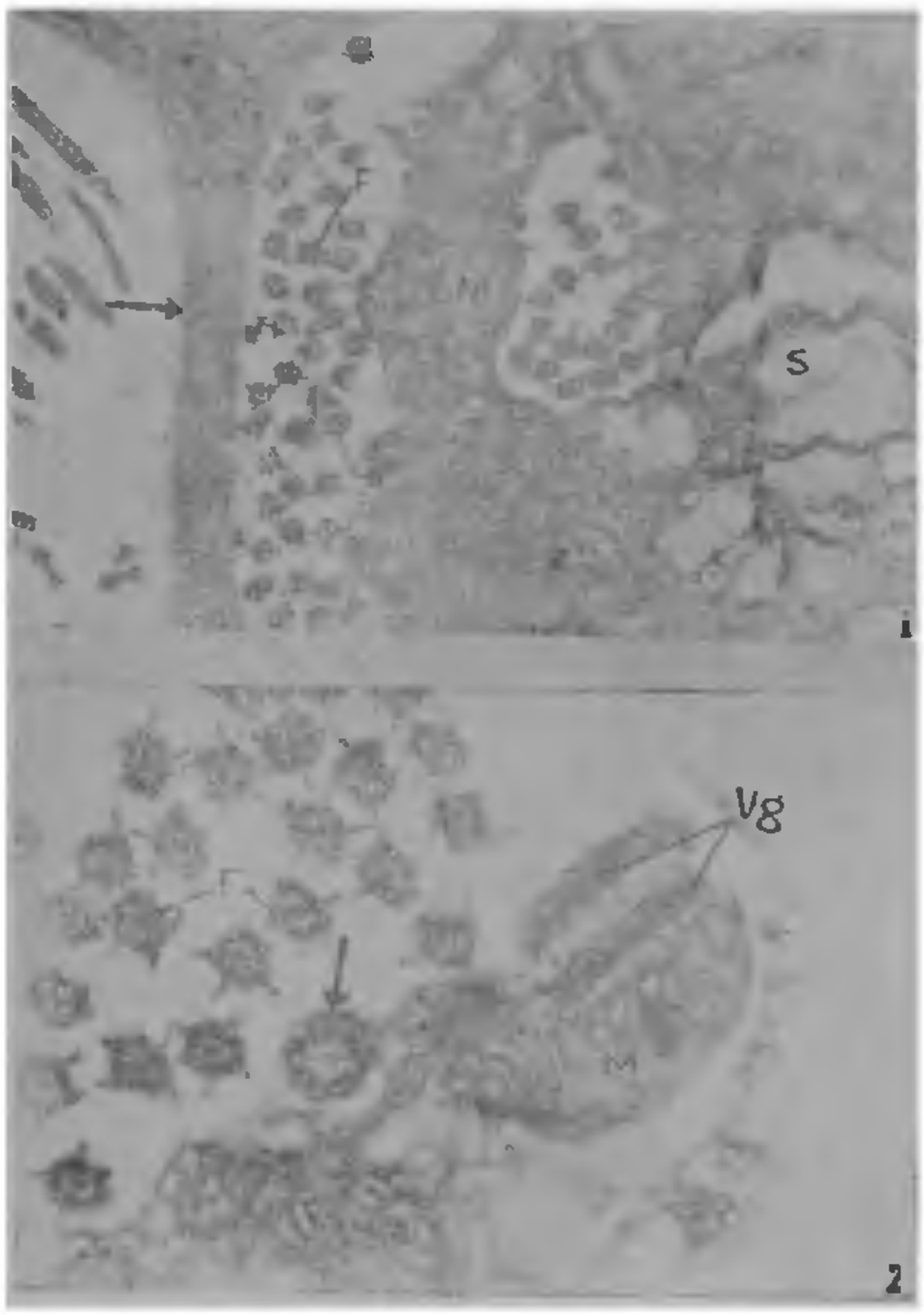

FIG. 1. T.S. through antheridia showing:

F.—Star-shaped flagella, M.—Mitochondrion. S.—Starch, Arrow showing cell wall (× 15,000).

FIG. 2. T. S. through antheridium showing:

F.—star shaped flagella, M.—Mitochondrion, Vg.—Vierergruppe. Arrow showing T.S. Basal part of flagellum (× 30,000).

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1. Carothers, Z. B. and Kreitner, G. L., *J. Cell Bio.*, 1967, 33, 43.
2. — and —, *Ibid.*, 1968, 36, 603.
3. Caulfield, J. B., *J. Biophys. Biochem. Cytol.*, 1957, 3, 827.
4. Manton, I., *J. Expll. Botany*, 1964 *a*, 15, 399.
5. Norstog, K., *Amer. J. Bot.*, 1967, 54, 831.
6. —, *Ibid.*, 1974, 61 (5), 449.
7. Paolillo, D. J. Jr., *Can. J. Bot.*, 1965, 43, 669.
8. Rice and Lastsch., *Amer. J. Bot.*, 1967, 54, 856.