

swamp in the middle of the township of Aiyetoro. The water-level was very low, probably at its lowest, and the brook traversing the swamp was a mere trickle. The swamp itself consisted, at this point, of thick black mud, more than 50 cm. deep and with practically no water above. An enormous growth of *Pistia* was resting directly on the mud surface, the lower layers forming a fairly compact mass of decaying vegetable matter. The two young *Erpetoichthys* were found in a lump of this mud, scooped out of the swamp a few metres from the brooklet and spread on the road.

Before being killed and preserved, the specimens were kept alive in an aquarium for about three weeks at University College, Ibadan. One was about 6 cm. in length, the other about twice as long, and both had well-developed external gills resembling those of larval *Polypterus*. Frequent air gulping seemed to indicate that the lungs were already functional; this took place at short regular intervals, even in well-oxygenated water.

The finding of larval *Erpetoichthys* at Aiyetoro was unexpected as the place was outside the known area of distribution of the species. *Erpetoichthys* is said not to occur west of the Ogun River system; but the small stream draining the swamp at Aiyetoro belongs to the more western Yewa system. Moreover, and probably more important, Aiyetoro is a typical inland locality, more than 80 km. from the lagoon and coastal swamps. This is in contrast to the statements in the literature, which describe *Erpetoichthys* as a coastal form, confined to deltas, lagoons and estuaries<sup>1</sup>, and raises the question whether this species migrates inland to spawn. If so, this would explain why searching for its young stages in the coastal region has not been successful.

A more complete account of the observations on larval *Erpetoichthys* will be published elsewhere. Field-work with the aim of throwing light on the distribution and breeding of this species is being continued.

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<sup>1</sup> Boulenger, A. G., "Catalogue of the Freshwater Fishes of Africa" 1 (London, 1909). Pellegrin, J., "Les Poissons des Eaux Douces de l'Afrique Occidentale" (Paris, 1923). Poll, M., *Rev. Zool. Bot. Afr.*, 35 (1942).

### Rate of Heat Production by Bull Spermatozoa

DURING some work on a problem unrelated to the present communication, a microcalorimeter was developed based on the 'Callendar Radio-balance'<sup>1</sup>. This calorimeter has been used for measuring the rate of heat production of unbuffered bull semen under anaerobic conditions, and although the calorimeter was not ideally suited to the work some results have been obtained which might be of interest to workers in the field of fertility.

Measurements were made on unbuffered whole semen from a bull of proved fertility. The measurement showed that there was a fall in rate of heat production from approximately 200 micro-watts/ml. of semen at 1 hr. after incubation at 37° C. to approximately 35 micro-watts/ml. of semen at 3 hr. These rates of heat production were, however, close to the sensitivity limit of the micro-calorimeter

(measurements made on 0.055-ml. sample) and for this reason the accuracy of the measurement is not high. T. Mann<sup>2</sup> has published a curve showing the normal course of fructolysis in an unbuffered specimen of good quality bull semen at 37° C. From the rate of disappearance of fructose, the rate of heat production has been estimated by making the following assumptions: (1) the process is anaerobic; (2) the principal heat-producing metabolic activity is fructolysis; (3) the semen from the bull on which the fructolysis measurements were made was similar to that on which our measurements were made as regards sperm quality, buffering capacity of semen, initial fructose content, etc.—the sperm density is known to be similar in both samples; (4) the heat liberated ( $\Delta H$ ) in the reaction, 1 gm. mole of fructose to 2 gm. mole of lactic acid, is 23,000 calories ( $\Delta F$  is approximately -47,000 calories).

The value so obtained for the rate of heat production 1 hr. after beginning of incubation at 37° C. is 160 micro-watts/ml. of semen. The trend of the curve for rate of utilization of fructose compares with that for the measured rate of heat production. The agreement of the measured and calculated values is encouraging and suggests that the method might be used for throwing additional light on the nature of the metabolic process (for example, whether fructolysis is the main energy-producing metabolic process).

It is interesting to compare these figures with an estimate of the energy requirement for spermatozoa movement made by Lord Rothschild<sup>3</sup> using formulae developed by Sir Geoffrey Taylor<sup>4,5</sup>. The estimates, using two separate formulae, are  $3.74 \times 10^{-7}$  erg/spermatozoa/sec. and  $2.04 \times 10^{-8}$  erg/spermatozoa/sec. The details are given in ref. 3 and the approximations in the hydrodynamic treatment are fully discussed in refs. 4 and 5. Our measurement converted to the same units is  $0.24 \times 10^{-5}$  erg/spermatozoa/sec. It appears, therefore, that on this basis the available chemical energy is much in excess of that required for propulsion.

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<sup>1</sup> Callendar, H. L., *Proc. Phys. Soc.*, 23, 1 (1910).

<sup>2</sup> Mann, T., *J. Agric. Sci.*, 38, 323 (1948).

<sup>3</sup> Rothschild, Lord, Ciba Foundation Symposium "Mammalian Sperm Cells" (Churchill, London, 1953).

<sup>4</sup> Taylor, Sir Geoffrey I., *Proc. Roy. Soc. A*, 209, 447 (1951).

<sup>5</sup> Taylor, Sir Geoffrey I., *Proc. Roy. Soc. A*, 211, 225 (1952).

### Geographical Zonation of Atypical Caryotypes in Shieldbugs

BOTANISTS have postulated polyploidy as an adaptation to cold; but it has been shown that in ferns polyploids occur more frequently in Ceylon than in western Europe<sup>1</sup>. Little or no geographical analysis has been attempted of the occurrence of atypical caryotypes in insects outside the genus *Drosophila*, although in the shieldbug genus *Thyanta* three neotropical species have  $2n = 14$  while three Nearctic species have  $2n = 16$ , 16 and 27 respectively<sup>2</sup>.

From a number of sources the published values of the diploid number of 151 shieldbug species have been extracted during the course of a revision of the