sea.[7, 8, 9] This suggests that freshwater animals may necessarily have a higher metabolic rate than their marine relatives. Data, however, are lacking on this score. We have therefore compared the oxygen consumption of marine and freshwater amphipods and isopods. To obtain significant data, nearly related anæsthetised animals of the same size and sex were used. We have found that the metabolic rate of the freshwater species *Gammarus pulex* is $1\frac{1}{2}$ times that of the marine *G. locusta* and *G. marinus*; and the metabolic rate of the freshwater *Asellus aquaticus* is 3 times that of the marine *Idotea neglecta*.

There is an equal absence of physiological data concerning freshwater animals limited in their distribution to swift streams and to still waters. Comparing the oxygen consumption of the larva of the mayfly *Bœtis rhodani*, an animal living in rapid streams, with that of its pond relative *Chlœon dipterum*, we find that the former has a value 3-4 times the latter. Moreover, the rates of their heart beats are as 3 : 1. Again, the metabolic rate of the caddis worm *Hydropsyche* sp., from rapid streams, is $1\frac{1}{2}$ times that of *Molanna* sp., from ponds. Finally, an unexpected difference in oxygen consumption was found between members of one and the same species from two such habitats. The ratio of the metabolic rate of *Asellus aquaticus* from a swift stream to that of members of this species from slow water is as 3 : 2. It is hoped that breeding experiments will decide whether the last-mentioned difference is inherited or not.

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[1] Krogh and Leitch, *J. Physiol.*, **52**, 288; 1919.
[2] Root, *Biol. Bull.*, **61**, 427; 1931.
[3] Gardner and Leatham, *Biochem. J.*, **8**, 374; 1914.
[4] Gardner, King and Powers, *Biochem. J.*, **16**, 523; 1922.
[5] Redfield, Coolidge and Hurd, *J. Biol. Chem.*, **69**, 475; 1926.
[6] Fox, NATURE, **130**, 92, July 16, 1932.
[7] Schlieper, *Biol. Rev.*, **5**, 309; 1930.
[8] Beadle, *J. Exp. Biol.*, **8**, 211; 1931.
[9] Raffy and Fontaine, *C.R. Soc. Biol.*, **104**, 466.

Nitrogen Requirements of the Lactic Acid Bacteria

IN view of the importance attached by Orla-Jensen to the nitrogen source employed in the study of the lactic acid bacteria—an importance emphasised by the results of our own studies—we have investigated the nitrogen distribution in some thirty-seven sources of nitrogen, and have determined the influence of these sources on the production of acid from glucose, mannose, and lactose by five strains of lactic acid streptococci after fourteen days' incubation at 23° C. For the nitrogen distribution determinations we used the method of Wasteneys and Borsook. In the subsequent preparation of the sugar broths for the fermentation work and in the recording of the results we proceeded after the manner of Orla-Jensen. Certain of the nitrogen sources investigated are available commercially; many, principally peptic, digests of casein and some tryptic digests of casein, are such as may readily be prepared by laboratory workers.

Each of the streptococcus strains studied produces an amount of acid comparable with that produced by certain strains of *Sc. cremoris* when a peptic digest of casein, 1 per cent total nitrogen content, is used as the nitrogen source; the broth thus prepared containing 57·69, 20·36, and 17·39 per cent of proteose N, peptone N and sub-peptone N respectively. If the total N, content be 0·5 per cent, the total titrable acidity is not more in each case than from one-half to one-third the amount already cited. A tryptic casein digest containing 1 per cent total nitrogen proves to be quite unsuitable as a nitrogen source for each of the organisms under study. When the total nitrogen content is 0·5 per cent, however, two strains are still feeble in the production of acid, but three strains produce from 6·0 to 8·6 grams acid (calculated as lactic acid) per mille. The tryptic casein digest broth contains 0·0, 27·68, and 69·82 per cent proteose N, peptone N, and sub-peptone N respectively. A commercial 'hydrolysed casein' broth prepared to contain 1 per cent total N shows an analysis of 35·84 per cent proteose N, 27·26 per cent peptone N, and 32·08 per cent of sub-peptone N. As a source of nitrogen this broth is very suitable for each of the five organisms, and particularly suitable for the three strains that, as described above, respond to a tryptic casein digest. Our results indicate that in fermentation studies on the lactic acid streptococci both the 'kind' and the 'amount' of nitrogen employed are critical.

This study is one of a series on cheese-ripening provided for by a research fund established jointly by the University of British Columbia and the Empire Marketing Board. A complete and detailed account of the work is in press awaiting the next issue of the *Journal of Dairy Research*, Cambridge.

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The So-called Marsupial Bone in a Microchiropteran

THE epipubic bone in Marsupialia is a diagnostic feature of the group, but it has not hitherto been recorded in other Mammalia except, of course, in the Monotremata. Recently I have collected *Rhinopoma*

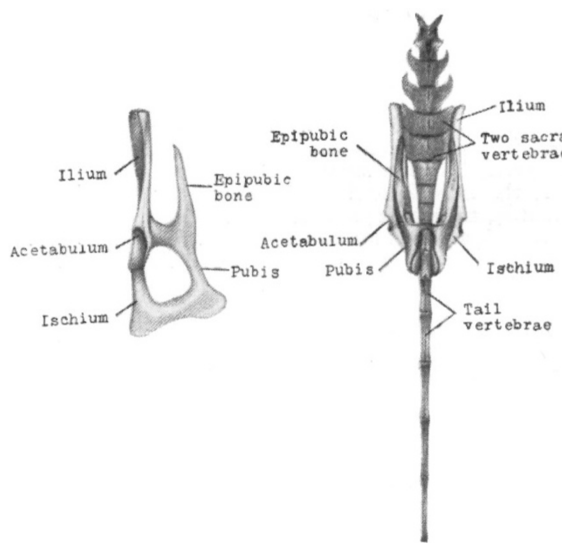

FIG. 1.—Pelvic girdle of *Rhinopoma microphyllum*. On the left, side view, $\times 2$; on the right, ventral aspect, $\times \frac{3}{2}$.

microphyllum, a small bat, from Agra Fort near the famous Taj, during the last departmental annual excursion. This bat possesses an epipubic bone which looks exactly like that of the kangaroo (Fig. 1). The whole skeletal system in *Rhinopoma microphyllum* is very peculiar and will be discussed elsewhere.

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