On the Storage and Mobilization of Organic Resources in the Hepatopancreas of a Crab (*Paratelphusa hydrodromus*)

It is well known that a cyclical accumulation of organic and inorganic reserves occurs in decapods, the major storage centre of these reserves being the hepatopancreas[1]. Very little information, however, is available regarding the cyclic changes in reserves of the hepatopancreas among the brachyurans during the moulting cycle. The present work deals with the changes in lipid and PAS-positive contents of the hepatopancreas in relation to parameters such as stages of growth and moulting.

Only juveniles of the crab *Paratelphusa hydrodromus* (Herbst) were used. Quantitative estimation of lipid contents was made by Soxhlet extraction technique using petroleum ether as the solvent, and PAS-positive substances were demonstrated by LILLIE's method[2].

Results. Based on the nature and distribution of cells, 3 zones may be detected in each lobule of the hepatopancreas of *Paratelphusa*. Zone I is comprised of embryonic cells, zone II the secretory cells and zone III, which occupies nearly $^3/_4$ of the lobule, the metal cells (iron cells and copper cells). In *Paratelphusa* iron and copper cells are found mixed with one another. Iron cells possess comparatively large-sized nucleus, conspicuous nucleolus and highly basophilic cytoplasm. The copper cells are more numerous, possess smaller nucleus and inconspicuous nucleolus and sometimes highly vacuolated cytoplasm. It is the metal cells that serve as storage centres for both organic (lipid, glycogen and protein) and inorganic (Ca and Mg salts) reserves.

In early postmoult (stage A–B), PAS-positive diastase-digestible granules are seen only within the vacuoles of the copper cells (Figure 1). During stage C_1, PAS-positive substances occur only in lesser amounts compared with early postmoult, and in C_3 they vanish almost completely.

PAS-positive granules reappear within the metal cells during stage C_4. By about mid-C_4 there is an abundance of these products in the metal cells (Figure 2). Two types of these granules are met with, one pale red or pink in colour and the other a deep scarlet. The former is perfectly spherical and usually distributed towards the outer cell membranes, sometimes in thick masses. The deep scarlet granules, on the other hand, are distributed throughout the cytoplasm.

PAS-positive granules decline considerably by early premoult (D_0) and almost disappear by stage D_1. But during D_2-D_3 all cells towards the interior of the lobules contain fairly rich quantities of deep red variety of these granules (Figure 3). But they again vanish on reaching stage D_4.

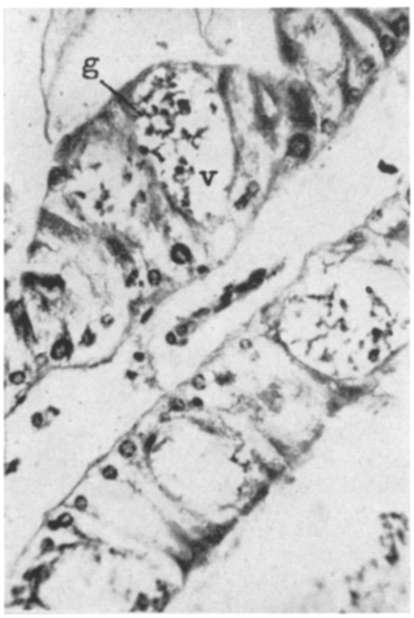

Fig. 1. Longitudinal section of the hepatopancreatic lobule of stage A-B individual. g, PAS-positive granules, v, vacuole (PAS). × 209.

Fig. 2. Stage C_4 hepatopancreatic lobule. d, pink granules, s, scarlet granules (PAS). × 1748.

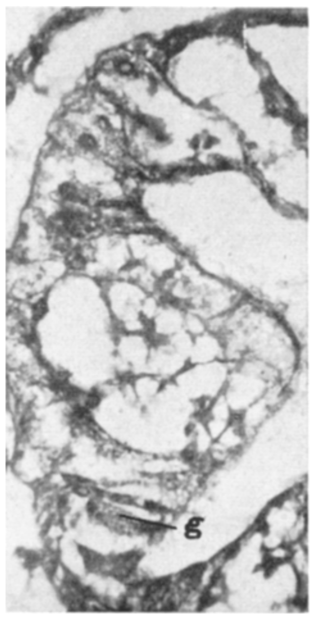

Fig. 3. Transverse section of the hepatopancreatic lobule during stage D_2-D_3. g, PAS-positive granules (PAS). × 400.

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[2] A. G. E. PEARSE, in *Histochemistry* (Churchill, London 1961).

Eyestalk extirpations were conducted on early C_4 animals. A month after the operation it has been observed that there is a steep decrease in PAS-positive contents of the hepatopancreas compared to controls.

The percentage content of lipid within the hepatopancreas of adult males of *Paratelphusa* at different stages of the moult cycle is listed in the Table.

Discussion. Glycogen plays an intermediary role in the formation of chitin[3]. In *Paratelphusa* most of the PAS-positive granules observed in metal cells may be only some sugars. The accumulation of these granules in C_4 in the metal cells appears to be characteristic of the decapods so far studied; they are completely withdrawn during D_0. But in cancer[3] the level of glycogen continuously increases during the early part of stage D as well. In *Paratelphusa* the PAS-positive substances reappear during the latter part of proecdysis (D_2-D_3), possibly due to be conversion of lipid into sugars to be utilized for the formation of chitin. Hepatopancreatic sugar disappears from D_4 to C_3, a feature associated with cuticular secretion. The conversion of lipid into glycogen and then to glucose for utilization in chitin formation has also been recorded by PASSANO[1]. It seems that some hormonal principle of the eyestalk is responsible for the changes taking place in the metabolism of these sugars within the hepatopancreas. This could be expected, because the whole phenomenon is related to the ecdysial cycle. It also explains the withdrawal of PAS-positive substances from the metal cells in C_4 individuals on ablation of the ocular peduncles. However, it may be noted that SCHWABE, SCHEER and SCHEER[4] found that similar operations on stage C *Palinurus* brought forth no change in the glycogen content of the hepatopancreas.

The decrease in the lipid content of the hepatopancreas towards the late premoult opposed to C_4 (Table) is possibly due to the rapid conversion of lipids into sugars to be utilized for chitin formation. Even after ecdysis, the total amount of lipid in the hepatopancreas goes down until stage C_3. The sugars produced by this conversion may be used for the chitinization of the endocuticle, a view in keeping with the observations of PASSANO[1] on cancer[5].

Concentration of lipid in the hepatopancreas of adult males of *Paratelphusa hydrodromus* in different stages of the moult cycle

	Postmoult A-B	Early intermoult C_1-C_3	Intermoult C_4	Premoult D
% of lipid	58 ± 5.8 (4)	25.8 ± 3.08 (4)	67.82 ± 5.36 (6)	49.93 ± 8.61 (4)

The numbers in parentheses indicate the numbers of animals.

Résumé. Etude des changements cycliques observés dans les hydrates de carbone et les lipides contenus dans l'hépatopancreas du crabe *Paratelphusa hydrodromus* pendant le cycle de mue.

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[5] Part of a thesis qualified for the award of Ph. D. degree of Kerala University. The author wishes to express her sincere thanks to Prof. K. K. NAYAR for his valuable guidance. Cost of maintainance during the tenure of the work was defrayed by U.S. Bureau of Commercial Fisheries (Contract No. 14-17-0007-233, PL-480 Funds).

Dosis-Wirkungs-Beziehungen zwischen Koronardurchfluss und Herzfrequenz für Adenosin

DRURY und SZENT-GYÖRGY[1] beschrieben 1929 die Wirkung von Adenosin am Säugetierherzen. Neben einem Anstieg des Koronardurchflusses kam es mit höheren Dosen zu einer Sinusbradykardie, zu Überleitungsstörungen und zu einem artrioventrikulären Block. Wegen seiner nur kurz andauernden koronarerweiternden Wirkung hat Adenosin jedoch keinen Eingang in die Therapie gefunden, jedoch wird ihm in Zusammenhang mit der koronarerweiternden Wirkung der Koronardilatatoren Dipyridamol und Hexobendin grosse Bedeutung zugemessen. Adenosin wird als die eigentliche koronarerweiternde Substanz angesehen. Es wird angenommen, dass die Wirkung auf einer Verlangsamung der Elimination von Adenosin beruht[2-6]. Da Adenosin nicht nur die Koronarien dilatiert, sondern auch die Erregungsleitung blockiert, schien es richtig, die Abhängigkeit der beiden Grössen von der Adenosindosis kennenzulernen.

Methode. Die Versuche zur Bestimmung der Dosis-Wirkungs-Beziehung zwischen Koronardurchfluss und Frequenz wurden am isoliert schlagenden Herzen nach LANGENDORFF[7] durchgeführt. Bei einem Teil der Versuche wurde der linke Ventrikel gefenstert. Mit Hilfe eines Gummikatheters wurde Flüssigkeit abgesaugt, die sich eventuell bei Insuffizienz der Aortenklappen im linken Ventrikel ansammelt und dadurch einen erhöhten Koronardurchfluss vortäuscht. Ein Vergleich dieser Versuche mit jenen ohne Absaugen ergab jedoch keinerlei Unterschiede. In die dem Herzen zuströmende Perfusionsflüssigkeit wurde alternierend 0,5 ml NaCl ohne Adenosin und 0,5 ml NaCl mit Adenosin in steigender Konzentration gegeben. Die Adenosindosen betrugen 0,1, 0,3, 0,5, 1,0, 3,0, 5,0, 10,0 und 30,0 µg/kg Körpergewicht des

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