MORPHOLOGICAL AND CYTOCHEMICAL STUDIES ON YOLK NUCLEUS DURING VITELLOGENESIS IN A MACRURAN *PANULIRUS HOMARUS* (MACRURA : CRUSTACEA)

ABSTRACT

The nucleolar extrusions containing proteins (-NH_2 and -SH groups ; and tyrosine) and RNA ; mitochondria containing phospholipids, proteins (-NH_2 and -SH groups ; and tyrosine) ; and Golgi bodies having phospholipids are concentrated in the form of the yolk nucleus in the vicinity of the nucleus in the early stages of oogenesis. The Golgi vesicles appear in the yolk nucleus in developing oocytes. Later on mitochondria, the L_1 bodies (Golgi vesicles) and nucleolar extrusions get distributed in the whole of ooplasm. RNA helps in protein synthesis and the Golgi vesicles get transformed into lipid yolk globules. Hence the yolk nucleus plays an indirect role in the initiation of vitellogenesis of *Panulirus*.

A SO-CALLED yolk nucleus has been described in various animal groups. In the vicinity of the nucleus different structures which are not comparable have been termed differently as yolk nucleus, centrosphere, archoplasm, corps vitellin and Balbiani body (Raven, 1961 ; Nath, 1968 ; and Nφrrevang, 1968). Only a few reports on yolk nucleus are available in crustaceans, viz., *Eucalanus elongatus* (Heberer, 1930) and *Artemia salina* (Anteunis *et al.*, 1966). To the best of my knowledge the yolk nucleus in *Panulirus* has not been worked out by any previous worker. Hence the present work was undertaken to study the morphology and cytochemistry of the yolk nucleus during vitellogenesis in *Panulirus homarus*.

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Discussion : The perinuclear yolk nucleus of *Panulirus* contains proteins, lipids and RNA. The yolk nucleus is not bounded by any membrane. Its perinuclear condition suggests some role of the nucleus in its initial formation.

The yolk nucleus in *Panulirus* is rich in RNA which has been reported in so many animal species (Rebhun, 1956 a, b ; Brachet, 1960 ; Raven, 1961 ; Nath, 1968 ; and Nørrevang, 1968). Heberer (1930) has also described nucleolar extrusions in *Eucalanus*.

Electron microscopists have made a valuable contribution in showing beyond any doubt that the yolk nucleus is of the nature of ergastoplasm or endoplasmic reticulum (Haguenau, 1958 ; André and Rouiller, 1957 ; Sotelo and Tujillo-Cenóz, 1957 ; Rebhun, 1956 a, b ; and see the review of Nørrevang, 1968 for references). Anteunis *et al.* (1966) in *Artemia* showed endoplasmic reticulum in the yolk nucleus and observed the presence of ribosomes in it.

The present studies show the presence of phospholipids and proteins in the granular mitochondria of yolk nucleus. Anteunis *et al.* (1966) have also observed mitochondria in the yolk nucleus of *Artemia*. Mitochondria containing phospholipids and proteins have been reported in vertebrates (Guraya, 1969 ; Chopra, 1958, 1960 ; and Nayyar, 1964) ; and spiders (Sareen, 1963, 1964 ; André and Rouiller, 1957 ; André, 1958 ; Dyal and Nath, 1933 ; Nath and Dhawan, 1954 ; Nath *et al.*, 1959 ; Koch, 1929 ; and van der Stricht, 1923). For more references see the reviews of Ravan, 1961 ; Nath, 1968 ; and Nørrevang, 1968.

The Golgi bodies (L_1 bodies) containing phospholipids, and the Golgi vesicles (L_2 bodies) containing triglycerides in their cortices and phospholipids in their interna develop in association with the yolk nucleus itself which is a compact structure. The lipid bodies in the yolk nucleus have been known as 'Golgi complex' or 'Golgi field' or 'Golgi zone' or 'Golgi apparatus' by electron microscopists (Yamada *et al.*, 1957 ; Sotelo and Porter, 1959 ; Odor, 1960 ; Anderson and Beams, 1960 ; Hashimoto *et al.*, 1960a, b ; and Blanchette, 1961). A few electron microscopists, *viz.* André and Rouiller (1957) and André (1958) on *Tegenaria* ; Sotelo and Trujillo-Cenóz (1957) on *Lycosa* have made a correlation of their electron microscopical studies of yolk nucleus with the light microscopic studies made by Nath (1968) and his collaborators. Anteunis *et al.*, (1964, 1966) have studied the ultrastructure of the Balbiani's body of *Artemia salina*. According to these workers the Balbiani's body consists of multivesicular bodies, dense bodies and small vesicles. Lipid bodies of similar morphology and histochemical nature are more highly developed in the oogenesis of reptiles, birds and mammals (Guraya, 1969).

Raven (1961) and Nath (1968) who summarized the electron and light microscopical observations concluded that the yolk nucleus in various modifications is probably a complex of ribonucleo-proteins arising from or in close association with the nucleus. As it grows the mitochondria and Golgi bodies are seen very closely associated with it. They later disperse throughout the ooplasm and contribute to the synthesis of proteins and lipids. The author is in agreement with Raven (1961) and Nath (1968).

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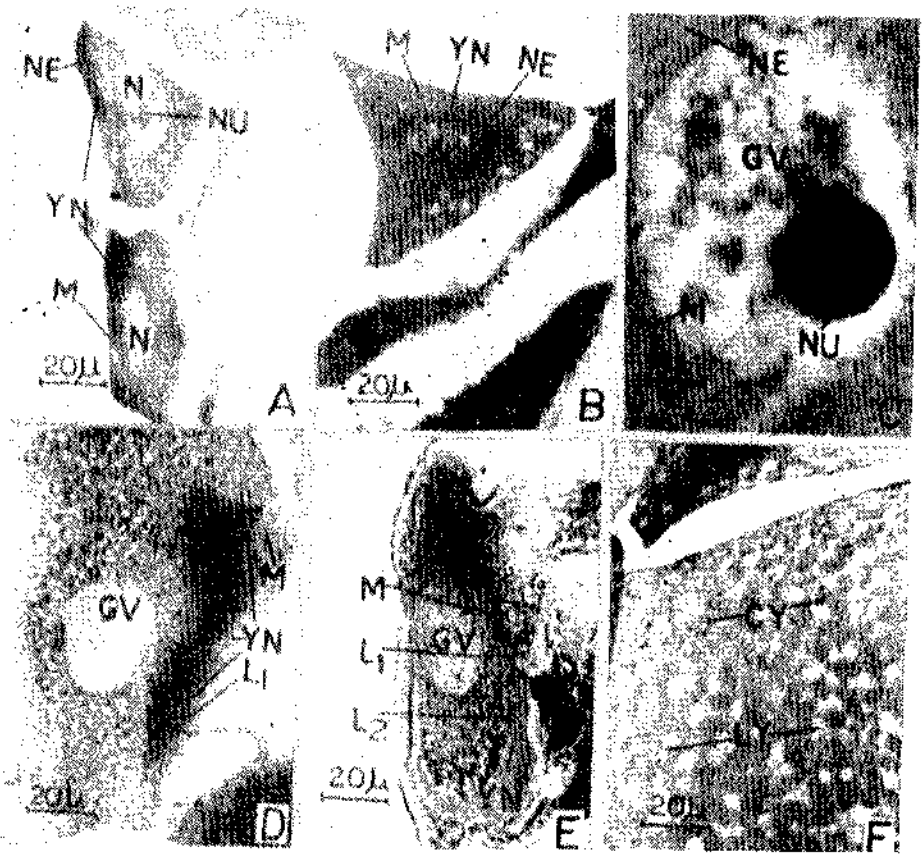

Plate I. A & B. Young oocytes showing the concentration of nucleolar extrusions (NE) and mitochondria (M) in the yolk nucleus (YN) near the nucleus (N), Zenker (MG-PG, & Zenker/ Hg-BPB ; C. Advancing oocyte showing even distribution of mitochondria (M) and nucleolar extrusions (NE) in the cytoplasm, Zenker Hg-BPB ; D. Advancing oocyte showing the concentration of mitochondria (M) and the Golgi bodies (L_1) in the yolk nucleus (YN), FCa PC-SBB ; E. Advancing oocyte showing appearance of the Golgi vesicles (L_2) at the sites of the yolk nucleus (YN), FCa PC-NBS ; F. Mature oocyte showing the compound yolk globules (CY) and vacuolar lipid yolk globules (LY negative in Hg-BPB, Zenker Hg-BPB. GV : germinal vesicle ; N nucleus.

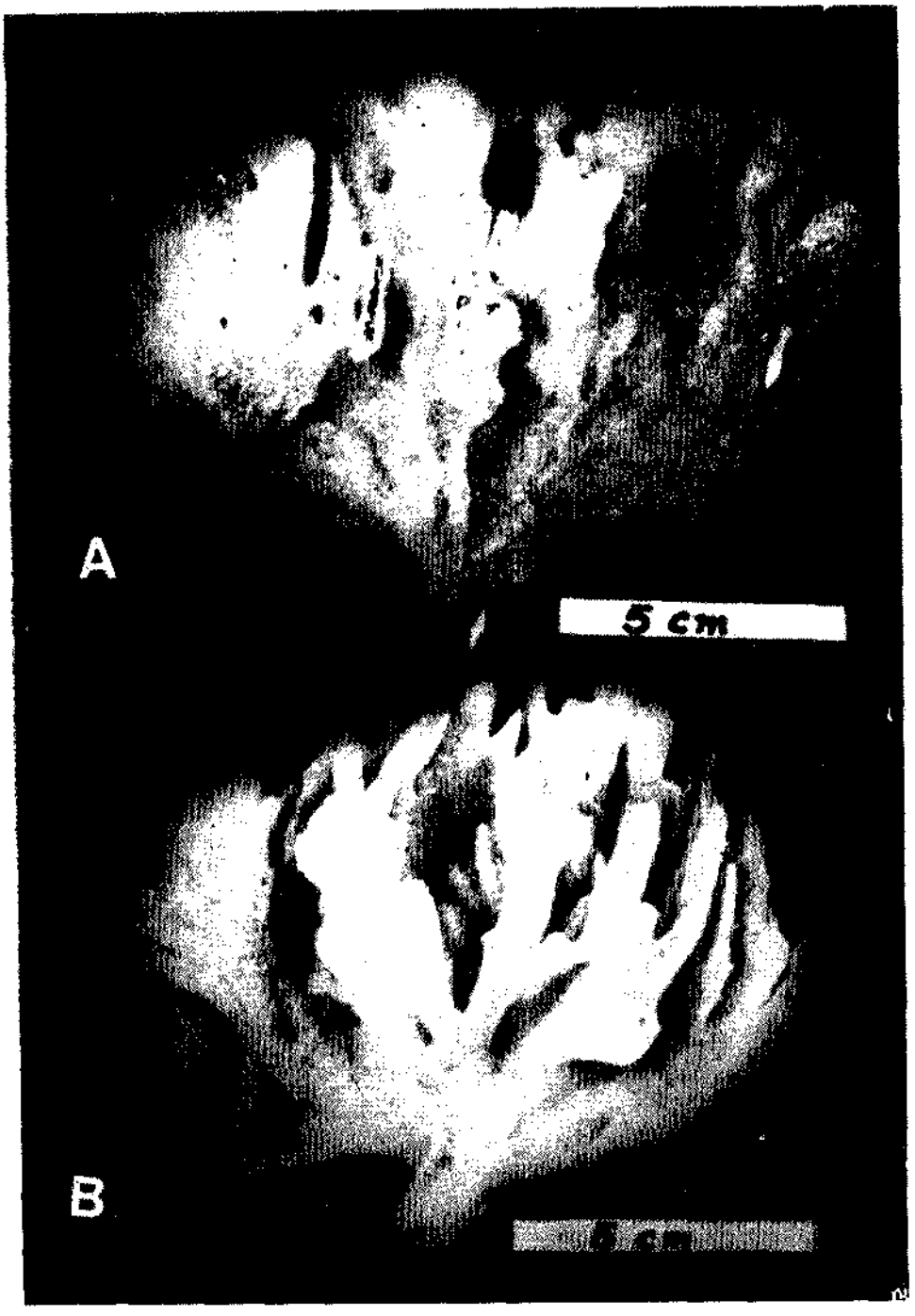

PLATE I A. *Endecryon lamellosa* sp. nov. specimen No. CMFRI-S. 55A and B (Type).