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Pleopod Tegumental Glands in the American Lobster (Homarus americanus)

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Betty Marie Johnson

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Thesis Committee:

Professor Prudence Talbot, Chairperson

Professor Roger D. Farley

Professor Leah T. Haimo

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Introduction

Tegumental glands in crustaceans and insects are present ubiquitously beneath cuticular surfaces and are reported to function in several capacities. The glands are known to secrete polyphenol oxidase in large quantities shortly after molting (Krishnan, '51; Stevenson, '61; Stevenson and Schneider, '62). Release of polyphenol oxidase catalyzes the oxidation of phenol to quinone, which combines with adjacent protein chains to harden and strengthen the cuticle (Stevenson and Schneider, '62). Some tegumental glands have the characteristics of transport epithelia and are presumed to function in ion and water translocation (Ejike and Ito, '78; Doughtie and Rao, '82).

Tegumental glands in the eyestalk of Homarus americanus (Arsenault et al., '79), in the gills of Palaemonetes pugio (Doughtie and Rao, '82), and in the head and mouth parts of Porcella scaber (Gorvett, '46) are organized in rosettes consisting of a canal cell and a cluster of secretory cells which are radially arranged around a central cell (Herrick, 1895; Yonge, '32; Gorvett, '46; Arsenault et al., '79; Aiken and Waddy, '82; Doughtie and Rao, '82). A small ductule passes through the center of the canal cell and conveys secretory product from the lumen of the gland to the exterior surface of the cuticle (Yonge, '32; Doughtie and Rao, '82). This arrangement of cells is quite similar to class III-type epidermal exocrine glands of insects as defined by Noirot and Quennedy ('74).

The pleopods of certain crustaceans also contain glands with this rosette type of structural organization (Herrick, 1893, 1895, '09; Yonge,

'32, '37). However, ultrastructural studies have not been done to confirm that they are in fact true tegumental glands. Pleopod glands in female H. americanus and other macrurans are generally considered to cycle in phase with the ovary and not with molting (Herrick, 1895; Yonge, '32, '37; Aiken and Waddy, '82). It has been clearly established that as the ovary develops, the pleopod glands become engorged with an opaque white substance (Herrick, 1893, 1895, '09; Yonge, '37; Stephens, '52; Lowe, '61; Cheung, '66; Waddy and Aiken, '80). The function of the pleopod glands is unresolved, but because they cycle with the ovary, and because of their location near the ovigerous setae, they are thought to be involved in the attachment of fertilized eggs to the ovigerous setae (Braun, 1875, 1876; Herrick, 1893; Yonge, '37; Silberbauer, '71; Fisher and Clark, '83). For this reason, they are sometimes referred to as cement glands (Aiken and Waddy, '82).

Despite this history of examination, there has been no ultrastructural study of the pleopod glands in Homarus or any crustacean; in fact, the only study to date on tegumental glands in Homarus has been on eyestalk tissue (Arsenault et al., '79). The purpose of this study has been to examine the ultrastructure of the pleopod glands in Homarus americanus, utilizing specimens of various sizes and in different stages of ovarian maturity. We will show that pleopod glands are present in juvenile and adult females. We will also show that these glands contain two types of secretory granule and that the glands have all the morphological features of true tegumental glands.