4-18-2012

The Role of Hemocytes in Shell Formation in the Eastern Oyster, Crassostrea virginica

Follow this and additional works at: https://ecommons.udayton.edu/stander_posters

Recommended Citation
https://ecommons.udayton.edu/stander_posters/135
The Role Of Hemocytes In Shell Formation In The Eastern Oyster, Crassostrea virginica

Cristina R. Prall, Nizar Raffoul, Karolyn M. Hansen

1Department of Biology, University of Dayton, Dayton, Ohio, 45469
2Department of Electrical Engineering, University of Balmand, El-Koura, Lebanon

BACKGROUND
• Oysters produce a protective composite shell that is composed of calcite and organic material, and have the ability to repair shell damage
• Hemocytes of oysters are known to play a role in shell formation
• Hemocytes of C. virginica contain calcium carbonate crystals that are transported through the tissue and deposited at the shell formation front

Hypothesis
- Hemocytes are capable of producing crystal structures when cultured ex vivo

METHODS
• Oysters obtained from Pemaquid Oyster Company, Waldoboro ME
• Cultured in re-circulating system and maintained on algal Shellfish Diet
• Oyster notched with tile saw, hemolymph extracted from adductor muscle, hemocytes isolated via centrifuge and washed three times with filtered seawater
• Hemocytes cultured ex vivo in Leibovitz L-15 growth medium for up to 96 hours
• At time intervals of 24, 48, 72, and 96 hours, hemocytes were prepared for analysis by rinsing, fixating and dehydrating
• Hemocytes placed on glass substrate for analysis on SEM

ABSTRACT
The Eastern oyster, Crassostrea virginica, produces a tough, fracture-resistant protective composite shell that is composed of calcite (a polymorph of calcium carbonate) as well as organic material (proteins, glycoproteins). Scientists have examined the shell formation process in molluscs for many decades and have proposed a model for the shell formation process. The hemocyte-mediated model proposes the role of oyster blood cells for transport of calcite nuclei to the shell formation front. Specifically, the hemocyte-mediated model proposes that the hemocytes of C. virginica contain calcium carbonate crystals that are transported through the tissues and deposited at the shell formation front. These nuclei then grow and coalesce to form the typical layered organic-mineral shell structure. This study focused on determining if hemocytes were capable of producing mineral structure when cultured outside the organism. Hemocytes were collected from notched oysters and cultured for up to ninety six hours ex vivo in order to determine if crystal formation occurred. Microscopic analysis (scanning electron microscopy, SEM) of the hemocyte samples revealed crystal structures within and around cells cultured on glass substrates. While elucidation of the basic biological process of shell formation is of great interest, there is potential for use of hemocyte crystal deposition for development of biomedical implant coatings. The biocompatible oyster-derived material may function as a better interface for integration of tissue with metallic implants.

RESULTS AND DISCUSSION
• Shell repair is evident within 24 hours of notching.
• The ex vivo culture of oyster hemocytes is successful within a 96 hour time period.
• The cells readily attach, spread and eventually deposit crystalline material on the culture substrates.
• There is potential for use of hemocyte crystal deposition for development of biomedical implant coatings.
• The biocompatible oyster-derived material may function as a better interface for integration of tissue with metallic implants.

ACKNOWLEDGMENTS
• Emily Untener, Doug Hansen, Yuhchae Yoon
• UD Honors Program Funding (to Emily Untener)
• Mr. Dale Grant (SEM)
• Okeanos Lab, Clemson University
• Air Force Office of Scientific Research – Interfacial Surface Science Program Project FA9550-06-1-0133