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Methods for studying biological preparations in hyperbaric environments

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Abstract

Atomic Force Microscopy (AFM), fluorescence microscopy (FM) and confocal scanning microscopy (CSM) were developed and tested inside a custom-designed hyperbaric chamber to provide the capability to study the biological preparations within an undersea hyperbaric environment. In this report we discuss details of installing an AFM, FM and CSM inside a hyperbaric chamber for simulation of a hyperbaric undersea environment and we use these technologies to study cellular structure and function. Electrical, gas and fluid lines were installed to enable remote operation of instrumentation under hyperbaric environments, and to maintain viable biological samples under temperature control and exposure to gas-equilibrated superfusate to various levels of oxygen. Results of these tests demonstrate subnanometer resolution under hyperbaric environments with AFM. Changes in cellular morphology and cellular ultrastructure (mitochondria, plasma membrane) could be assessed with hyperbaric AFM, FM and CSM. These measurements were made on a variety of living cell cultures exposed to graded levels of hyperbaric environments and hyperbaric gases. Hyperbaric AFM, FM and CSM techniques are presented as useful methods to study the cellular and physiological effects of hyperbaric undersea environments and the biological adaptations required to adapt to these environments.

Biography

Dominic D'Agostino, Ph.D. is an Assistant Professor since 2008 at the University of South Florida Morsani College of Medicine in the Department of Molecular Pharmacology and Physiology. His research is focused on hyperbaric physiology, hyperbaric cellular biology, neuropharmacology, medical biochemistry, cancer biology, cellular metabolism and intracellular signaling. As a researcher, Dominic D'Agostino enjoys support from the Office of Naval Research (ONR), Department of Defense (DoD) and private foundations for studying the cellular and physiological effects of hyperbaric undersea environments.