The Development of a Hyperbaric Upright Epifluorescence Hoffman® Contrast Microscope for Whole-Cell Electrophysiology Recordings Following Exposure to Varying Gas Mixtures

Abstract

Two of the long studied, but poorly understood stimuli that adversely affect CNS function, are pressure \textit{per se} (barosensitivity) and gas narcosis. Likewise, the mechanisms underlying their interesting interactions—anesthetic/narcotic gas-reversal of pressure effects and \textit{vice versa}—is poorly understood at the cellular level. To address this issue we have designed and fabricated a hyperbaric (3.457 MPa) \textit{“patch-clamp”} system to address said effects on voltage- and ligand-gated ionic conductances. While presynaptic mechanisms are implicated in the neurogenesis of barosensitivity (\textit{i.e.,} modulation of neurotransmitter release); evidence also exists for postsynaptic mechanisms in the formation of barosensitivity (\textit{i.e.,} likely changes in receptor affinity and ion channel modulation). Therefore, an \textit{in vitro} analysis of barosensitivity/gas narcosis is warranted. We have created a \textit{“HYPERBARIC (3.457 MPa) UPRIGHT EPIFLUORESCENCE HOFFMAN® CONTRAST MICROSCOPE FOR WHOLE-CELL ELECTROPHYSIOLOGY RECORDINGS FOLLOWING EXPOSURE TO VARYING PARTIAL PRESSURES OF He, N$_2$, AND A He/N$_2$ MIX AT A CONSTANT 21 KPa O$_2$ and 5 KPa CO$_2$” as defined in the title. The system is designed as an enabling technology in the nascent field of hyperbaric pharmacology.

Subject Terms

Cellular, Chamber Diving, Electrophysiology, Epifluorescence Excitable, Fluorescence, Gas, Helium, Giga Ohm Seal, Hyperbaric, Inert, Ion Channel, Microscopy, Narcosis, Nitrogen, Oxygen, Pascall Partial Pressure, Patch Clamp, Perfusion, Recordings, Voltage-Clamp, Whole-Cell