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A perfusion system for the fluorescence-based monitoring of physiological responses to high hydrostatic pressures[1] PAUL URAYAMA, JEFF MALTAS, ZAC LONG, ALISON HUFF, Miami University — Hydrostatic pressures of a few-hundred atmospheres affect biological components and processes, for example, the stability of macromolecular assemblies, the biophysical properties of membranes, enzymatic activity, and protein structure. These in turn lead to a range of pressure effects on cellular physiology. Here we present a mirco-perfusion system designed for the real-time spectroscopic monitoring of cellular systems under high pressure. The system consists of an optically-compatible pressure chamber and interchangeable fluid reservoirs. Perfusion is achieved using a dual pressure-generator configuration, where one positive-displacement generator is compressed while the other is retracted, thus maintaining pressure while achieve fluid flow. Control over perfusion rate (typically in the 10 μl/s range) and the ability to change between fluid reservoirs while under pressure (up to 600 atm) is demonstrated. The real-time monitoring of the response of cellular autofluorescence to mitochondrial functional modifiers (e.g., cyanide) while under pressure is also demonstrated.

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