

UNIVERSITY OF IDAHO
DEPARTMENT OF MATHEMATICS AND
STATISTICAL SCIENCE

COLLOQUIUM

Thursday, October 30, 2025

Talk begins at 3:30 p.m.

TLC 148

Refreshments in Brink Hall Room 305 at 3:00 p.m.

Join Zoom Meeting

<https://uidaho.zoom.us/j/83103384490> Meeting ID: 831 0338 4490 Passcode: 552030

Mathematical Modeling of Coupled
Cardiovascular-Ocular Hemodynamics

Sergey Lapin

Washington State University, Department of Mathematics and Statistics

This presentation introduces Eye2Heart, an integrated mathematical framework linking cardiovascular and ocular hemodynamics through a system of nonlinear ordinary differential equations. The model, verified with experimental and clinical datasets, successfully reproduces both systemic and ocular physiological markers. Computational experiments indicate that increased intraocular pressure primarily reduces ocular perfusion, whereas diminished left ventricular compliance leads to decreased cardiac output and retinal blood flow. When both factors coexist, venous circulation is further compromised, offering mechanistic insight into disorders such as normal-tension glaucoma. By quantitatively bridging the eye and heart, Eye2Heart establishes a foundation for oculomics that complements AI-driven image analysis and advances physiologically informed approaches to precision medicine.

