THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

# Biotransport

## BIOMEDE 4210

**Credit Hours:**
3.00 - 3.00

**Course Levels:**
Undergraduate (1000-5000 level)

**Course Components:**
Lecture

**Course Description:**
Covers key transport concepts in biomedical engineering. Emphasis is put on mass and momentum transport with applications related to biology, medical science and biotechnology.

**Prerequisites and Co-requisites:**
Prereq: 2000 and Math 2174, or permission of instructor. Concur: MechEng 3500 or FABEng 3120.

**Course Goals / Objectives:**
- Define each term in the overall equation of continuity, the species mass balance equation (species continuity equation), the laws of diffusion, and the conservation of momentum equation
- Apply momentum and mass balances to describe standard transport problems, and, when possible, solve them analytically
- Formulate the same conservation equations to describe biotransport problems, and, when possible, solve them analytically

**Course Topics:**

- Introduction on the role of transport processes in biological systems. Definition of transport processes, transport at the cellular level, physiological transport systems. Applications in disease pathology, treatment and device development.
- Physiological fluid mechanics (Fluid kinematics; Constitutive relations; Momentum balances and applications; Rheology and flow of blood).
- Conservation relations for fluid transport (Equation of conservation of mass; Equation of conservation of linear momentum; Navier-Stokes equations for an incompressible Newtonian fluid; Dimensionless form and groups).
- Mass transport in biological systems (constitutive relations; steady-state diffusion in one dimension; radial diffusion in cylindrical or spherical coordinates; unsteady diffusion in one dimension; protein adsorption to biomaterials).
- Diffusion-limited reactions (diffusion-limited binding between a cell surface protein and a solute; diffusion-limited binding on a cell surface).
- Diffusion with convection (conservation of mass for dilute solutions; mass transfer coefficient; mass transfer across membranes: hemodialysis).
- Mass transport and biochemical interactions (chemical kinetics and reaction mechanisms). Mass transport at the cellular level (receptor-ligand binding kinetics on the cell surface and molecular transport within cells).
- Transport of gases between blood and tissues (oxygen-hemoglobin equilibria; oxygen delivery to tissues). Transport in organs and organisms (pharmacokinetic models).

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**Designation:**

Elective