# Biotransport Phenomena (3 Credits)

## Instructor
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## Synopsis
The course introduces the physical factors governing the transport of momentum, heat and mass, and how they operate in biological systems. Students will learn how to quantify the transport of these quantities by using basic equations of fluid mechanics (mass conservation, Bernoulli, generalized Bernoulli) and of heat and mass transfer (convection-diffusion equation). The course covers examples such as gas exchange in lung, inter cellular signal transport in bone, blood flow in cardiovascular system, heat exchange in human body, and chemotransport and momentum transport in several in vitro experimental systems. Student will be assigned pertinent research papers on bio-transport and will be required to present their understanding and analysis of the work done.

## Offering
2015 Julmester

## Audience
Year 3 & 4 Undergraduate and Graduate Students

## Classroom
Room xxx, Teaching Bldg. No. XX, Peking University

## Schedule
**Class:** 2-5 PM, M-F, July 6-24, 2015; **Final Exam:** 2-5 PM, July 25, 2015

## Objectives
- To understand the physical factors governing the transport of momentum, heat and mass, and how these factors operate in biological systems.
- To develop the ability to quantify the transport of these quantities by using basic equations of fluid mechanics (mass conservation, Bernoulli, generalized Bernoulli) and of heat and mass transfer (convection-diffusion equation).

## Syllabus

### INTRODUCTION
- What is Biotransport?
- Stresses
- Fluid Properties
- Units
- Fluid Kinematics

### CONTROL VOLUME APPROACH
- Control Volumes
- Reynolds Transport Theorem
- Mass conservation
- Control volume form of momentum equation

### DIFFERENTIAL APPROACH
- Fluid Statics
- Buoyance
- Fluid Rheology
- Continuity Equation
- Navier-Stokes Equation
- Euler and Bernoulli Equation

### DIMENSIONAL ANALYSIS
- Pi Theorem
- Similitude

### REAL FLOWS
- External Flow: Boundary Layer Theory
- External Flow: Turbulent Boundary Layers
- External Flow: Drag and Drag Coefficient
- Inner Flow: Laminar Flow in Conduits
- Inner Flow: Turbulent Flow in Conduits–Moody Chart
- Inner Flow: Generalized Bernoulli Equation

### MASS TRANSFER
- Mass Fluxes
- Governing Equations
- Boundary Conditions
- Steady Diffusion
- Convective Mass Transfer
- Concentration Boundary Layer
- Mass Transfer in Ducts

### HEAT TRANSFER
- Introduction
- Combined Heat Transfer
- Energy Equation
- Convective Heat Transfer

**STUDENT PRESENTATIONS**

## Text

## Grading
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