# PCEUT 506

# Concepts in Pharmaceutical Sciences II

Winter Quarter 2018 (4 credits)
Lectures: Mon and Fri 2 - 4 pm
Location: HSB H074

# Course Organizer

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# Course website

# <https://canvas.uw.edu/courses/1126755>

# Course Goals:

The goals of the course are to provide the student with: (i) an introduction to pharmacokinetics which is a key disciplinary area within the pharmaceutical sciences and a cornerstone of clinical pharmacology and therapeutics; (ii) the foundation of pharmacokinetic knowledge needed for the advanced graduate Pceut series (PCEUT 501, 502 and 503); and (iii) the computational skills and analytics to solve pharmacokinetic problems. Prerequisite: completion or concurrent enrollment in Pceut 532, or by approval of the instructor.

# Learning Objectives:

1. To understand rates processes and mathematical treatment of first-order kinetics
2. To define the basic pharmacokinetic parameters of a drug and how these parameters are inter-related
3. To demonstrate how compartmental models can be used to explain plasma concentration-time profiles with emphasis on the one-compartment model
4. To understand clearance concepts, including additivity of clearances, organ clearance, hepatic and renal clearance models, physiological basis of clearance, and Michaelis-Menten kinetics
5. To understand the factors that determine plasma drug concentrations during multiple dosing
6. To illustrate the clinical application and relevance of pharmacokinetic calculations
7. To understand the biopharmaceutical and pharmacokinetic characteristics of various routes of drug administration

# Performance Objectives:

Upon completing the course:

1. Given a set of data, the student will be able to construct basic spreadsheets of plasma concentration *vs.* time data, present data appropriately in graphs, tables and figures and calculate pharmacokinetic parameters
2. Given the literature or findings on the pharmacokinetics of a drug, the student will be able to extract the relevant information and present it to peers
3. Given a set of pharmacokinetic parameters, the student will be able to: 1) conceptually explain the interdependence and independence of the parameters; 2) quantitatively explain the relationships between physiological values and the obtained parameters; and 3) construct hypotheses of the mechanisms underlying the pharmacokinetic behavior
4. Given the information of elimination pathways involved, the student will be able to predict differences in drug disposition in different clinical populations

# Textbooks:

*Clinical Pharmacokinetics and Pharmacodynamics*. *Rowland M and Tozer T, 4th edition, Lippincott Williams and Wilkins (Required)*

*Textbook of Medical Physiology. Guyton and Hall: 11th edition (Highly recommended)*

# Course Structure:

The course structure combines student self-study with discussions of pharmacokinetic concepts, computational exercises, and homework assignments. The lectures will follow the materials in the textbook "*Clinical Pharmacokinetics and Pharmacodynamics*" which is available from the bookstore. In addition, the students are expected to obtain basic knowledge of human physiology with emphasis on circulation, metabolism, gastrointestinal, liver and kidney function. The recommended reading for physiology is *Textbook of Medical Physiology*.

Students are expected to participate in group discussion, raise questions related to the material, and complete any assigned reading. Homework assignments will be distributed weekly. These homework assignments must be completed and returned to the assigning faculty member by the due date. Faculty will be available to answer questions the students have of the material through individual appointments. The TA will be available throughout the course for informal sessions to assist in solving the study assignments and help the students with the material.

# Software:

Excel and Phoenix (WinNonlin) will be used for the homeworks. Please see the Canvas course site for instructions for downloading and installing Phoenix.

# Grades:

Grades for the course will be assigned based on a written in-class midterm and comprehensive final exam, 9 homework assignments, and participation in class discussion. The percentage for each item is as follows:

Midterm exam 40%

Final exam 45%

Homework assignments (9 assignments) 15%

# Office Hours:

Arranged by each faculty member

# Accommodations:

If you would like to request academic accommodations due to a disability, please contact Disabled Student Services, 448 Schmitz, 543-8924 (V/TTD). If you have a letter from Disabled Student Services indicating you have a disability that requires academic accommodations, please present the letter to the instructors so we can discuss the accommodations you might need for the class.

# Accommodations:

**Lecturer** **Office** **Email**

YL Yvonne Lin, PhD H272 O yvonlin@uw.edu

JU Jashvant Unadkat, PhD H272 L jash@uw.eduJW Joanne Wang, PhD H272 J jowang@uw.edu

KT Kenneth Thummel, PhD H272 N thummel@uw.edu

CY Cathy Yeung, PhD, PharmD cathyy@uw.edu

# TA

Marc Vrana

mvrana@uw.edu

Office hours TBA

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| **Lecture #** | **Date** | **Day** | **Lecturer** | **Lecture** | **Homework** |
| 1 |  Jan 5 | F | KT | Overview: Enzymes | #1 (KT) Enzyme kinetics |
| 2 | Jan 8 | M | KT | Overview: Enzymes - kinetics |  |
| 3 | Jan 12 | F | JW | Overview: Transporters |  |
| 4\* | Jan 15 | M | YL | Modeling concepts and techniques I | #2 (YL) Estimation of 1 compartment PK parameters |
| 5 | Jan 19 | F | YL | Modeling concepts and techniques II |  |
| 6 | Jan 22 | M | YL | Kinetics of multi-compartmental modeling / Distribution kinetics | #3 (YL) Estimation of multi-compartmental PK parameters |
| 7 | Jan 26 | F | YL | Clearance concepts – experimental approaches |  |
| 8 | Jan 29 | M | JU | Advanced CL models including permeability limitations | #4 (JU) Extended CL model |
| 9 | Feb 2 | F | YL | Oral dosing: First pass, oral clearance and kinetics (including enterohepatic recycling)  | #5 (YL) Integration of kinetic and physiological concepts |
| 10 | Feb 5 | M | YL | Clearance concepts – IV and oral |  |
| **11** | **Feb 9** | F |  | **Midterm exam** |  |
| 12 | Feb 12 | M | YL | Advanced distribution kinetics | #6 (YL) Distribution kinetics |
| 13 | Feb 16 | F | KT | Inhibition and induction kinetics for enzymes & transporters |  |
| 14\* | Feb 19 | M | KT | In vitro-in vivo extrapolation, allometry and introduction to physiologically-based pharmacokinetic modeling  |  |
| 15 | Feb 23 | F | CY | Renal and hepatic impairment | #7 (CY) Impairment |
| 16 | Feb 26 | M | JW | Transporters: mechanisms, kinetics and experimental approaches | #8 (JW) Transport study design and data analysis |
| 17 | Mar 2 | F | KT | Integration of PK principles through case studies I (emphasis on drug metabolism) |  |
| 18 | Mar 5 | M | JU | Integration of PK principles through case studies II (emphasis on transport) |  |
| 19 | Mar 9 | F | JU | PK-PD principles including collapse of the hysteresis loop | #9 (JU) Semi- parametric PKPD modeling |
|  | **TBD** |  |  | **Comprehensive Final Exam** |  |