PHA6418 Introduction to Model-Informed Drug Development (MIDD)
Fall 2023
3 Credit Hours – A-E Grading

Course Description
Introduction to Model-Informed Drug Development (MIDD) is a 3-credit course that serves as a broad overview of applying modeling and simulation strategies to improve drug development decision-making and trial designs. Examples of applications include translational approaches from preclinical to clinical research, translation from biomarker to a clinical endpoint, dose-finding during Phase 1 and 2, clinical confirmation during Phase 3, avoiding the need for certain clinical trials, characterizing sources of variability in drug response, regulatory interactions, and post-marketing assessment. Upon completion of the course, students will have a basic understanding of how model-based drug development can be applied to help bring new drugs to market more efficiently.

Course Coordinator
Francine Johansson Azeredo, PhD (francinej@ufl.edu)

Participating Faculty
Thomas Schmittgen, PhD
Guenther Hochhaus, PhD
Stephan Schmidt, PhD
Brian Cicali, PhD
Richard Lalonde, PharmD
Mark Rogge, PhD

Program Coordinator
Nasser Nassiri Koopaei, PhD (koopaei@ufl.edu)

Course Faculty
Lectures will be provided by numerous adjunct faculty members from the pharmaceutical industry with vast experience in model-based drug development. Details and biographical sketches of the faculty can be found on the Canvas course site.

Course-Level Objectives
Upon completion of this course, the student will be able to:

1. Discuss and appreciate the role of model-informed drug development during the following stages: discovery, preclinical, clinical, regulatory review, and post-approval.
2. Identify specific drug development questions or issues that can be addressed using MIDD.
3. Select and apply pharmacometrics method(s) used in MIDD: population PK or PK-PD, clinical trial simulation, meta-analysis, systems pharmacology, PBPK, etc.
4. Contrast MIDD applications to support regulatory agency decisions versus drug development decisions within the pharmaceutical industry.
5. Understand the development strategies for various therapeutic areas and identify the question that needed to be answered using MIDD
6. Describe MIDD approaches used to answer the above question: e.g., modeling, simulation, results, key assumptions, and uncertainties.
7. Explain the impact of MIDD on specific drug development examples and regulatory decisions or interactions.
8. Apply MIDD concepts to all Phase(s) of drug development: preclinical, Phase 1, 2, 3, regulatory agency interactions, and post-regulatory approval.

9. Explain the critical aspects of conducting clinical trials, including human subject protections, Phase 1, 2, and 3 trials, regulatory requirements, and clinical data management.
10. Answer specific drug development questions or issues that MIDD can address: dose selection, trial design for Phase 1, 2, or 3, go/no go, labeling, development strategy, avoiding the need to conduct a clinical trial, selecting between compounds in development, etc.
11. Apply MIDD to various therapeutic areas: cardiovascular, neuroscience, metabolic diseases, oncology, rare diseases, etc.

Course Pre-Requisites: none
Course Co-Requisites: none
Course Contact Hours: 45

Course Outline
Please routinely check your campus calendar and the Canvas course site for any messages about changes in the schedule and deadlines.

Every week, two lectures will be assigned and made available online. In addition, reading assignments will be provided related to the recorded lectures. The students can watch these lectures at any time. Furthermore, an active learning session (ALS) will be held that will allow interactive participation by the students. The time of the ALS will be **12:00-1:00 EST on Thursdays**. Please see the comment below on ALS attendance.

Week	Lecture available	ALS	Topic	Lecturer	ALS coordinator
1	Aug 23rd	Aug 24th	Course overview; Overview of Model-Informed Drug Development;	Lalonde; Schmittgen	Azeredo
2	Aug 28th	Aug 31st	Introduction to Population PK-PD; The usage of monoclonal antibody models for the expansion of the Xolair (omalizumab) dosing table to support an unmet medical lead	Azeredo; Tannenbaum	Azeredo
3	Sept 4th	Sept 7th	How technical pieces of MIDD are included in submissions for an IND/CTA/NDA/MAA, and best practices for including this information	Schmith	Azeredo
4	Sept 11th	Sept 14th	MIDD for New Drug Development; MIDD in the early stages of drug development	Zhu; Barth	Azeredo
5	Sept 18th	Sept 21st	TBD; MIDD to support regulatory concerns in pediatrics	Goyal; Uchoa	Azeredo
6	Sept 25th	Sept 28th	Streaming approval for generic drug inhalation	Hochhaus	Azeredo; Hochhaus
7	Oct 2nd	Oct 5th	MIDD Dose Optimization Oncology; MI Dosing Recommendation using PBPK and Translation to Prescribing Information	Gupta	Azeredo; Cicali/ Schmidt
	Week of Oct 12th		**Midterm Exam**		
8	Oct 16th	Oct 19th	Translational drug development using MIDD	Vozmediano; Rodriguez	Azeredo
9	Oct 23rd	Oct 26th	MIDD Approaches for Vaccine Development; Decision-making in Pharma R&D with a focus on MIDD	Kandala; Weber	Azeredo
10	Oct 30th	Nov 2nd	Translation Modeling: How to predict FIH dose for clinical trials?; Using Clin Pharm and PMX to	Trame	Azeredo

			accelerate cell therapeutics development: A Patient's CAR-T journey		
11	Nov 6th	Nov 9th	MIDD applications when organ impairment is a determinant of dose; Pharmacometric Approaches for change in Dosing Regimen for Anti-PD-1 monoclonal Antibodies	Rogge; Davis	Azeredo; Rogge
12	Nov 13th	Nov 16th	TBD	Lesko	Azeredo
13	**Nov 23rd**		**No classes - Thanksgiving Break**		
14	Nov 27th	Nov 30th	Model-Based Meta-Analysis (MBMA) to Support Phase 3 Dose Selection of Apixaban	Byon	Azeredo
15	Dec. 4th	Dec 7th	Optimizing efficacy and minimizing toxicity through data-driven drug dose and schedule selection; Course closure and overall discussion	Chapel; Azeredo	Azeredo
	Week of Dec 14th		**Final Exam**		

Lecture videos will be released on the Monday of each week.
An active learning session (ALS) will be held each Thursday from 12:00-1:00 PM EST via Zoom, accessible through the course calendar on Canvas. The meeting will cover both lectures from the previous week, with lecturers joining the call to answer students' questions.

Recommended Textbooks

- Title: Applied Pharmacometrics
- Authors: S. Schmidt, H. Derendorf
- AAPS Press/Springer
- 2014
- ISBN number: 978-1493913039

- Title: Rowland and Tozer's Clinical Pharmacokinetics and Pharmacodynamics: Concepts and Applications
- Authors: H. Derendorf, S. Schmidt
- Wolters & Kluwer
- 2020
- ISBN number: 978-1496385048

Additional reading assignments will be made available on the Canvas course site.

Quizzes

There will be three 5-questions quizzes.

Discussion Boards
See affiliated course materials for instructions.

Materials & Supplies Fees
None

Student Evaluation & Grading
Evaluation Methods and How Grades are Calculated.

Assessment Item	Grade Percentage
Class participation	10%
Quizzes (3X10%)	30%
Midterm exam	30%
Final exam	30%

Percentage Range	Letter Grade
92.50-100%	A
89.50-92.49%	A-
86.50-89.49%	B+
82.50-86.49%	B
79.50-82.49%	B-
76.50-79.49%	C+
72.50-76.49%	C
69.50-72.49%	C-
66.50-69.49%	D+
62.50-66.49%	D
59.50-62.49%	D-
< 59.50%	E

Class Attendance Policy
Pease refer to UF attendance policy: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Students are required to watch lectures within the period that is indicated in the syllabus. Conflict with work schedules is not an excused absence for not watching the lectures.

Class attendance is mandatory for all active learning sessions (ALS). Student attendance may be excused by Dr. Schmittgen in the following situations: documented illness, family emergencies, religious holidays, and other reasons of serious nature. Conflict with work schedules is an unexcused absence.

Requests for excused absences MUST be made by an email prior to the scheduled session.
The student is responsible for follow up. Failing to follow this policy will render the absence not excusable. A request for an "excused absence" does not guarantee acceptance. No precedence can be drawn from any courses in the College of Pharmacy or any other college within University of Florida.

Makeup exam or quiz(s) will be made for any excused absence(s) and must be submitted ***within one-week of the missed session(s)***. If the situation leads to missing multiple class sessions and makeup becomes difficult, the student and course coordinator will discuss with the administration to explore options such as a remediation plan or course withdrawal. There will be a one-point deduction for missing any ALSs up to 5% of the final grade.

Academic Integrity Policy
Students are expected to act in accordance with the University of Florida policy on academic integrity (http://www.dso.ufl.edu/sccr/honorcodes/honorcode.php). This Honor Code specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obliged to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult the course's Teaching Partnership Leader. Students are also expected to abide by the UF Honor Code.

The following is the UF Honor Pledge: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity by abiding by the Honor Code.
On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment.