

Applied Biopharmaceutics and Pharmacokinetics

PHMD 2006

Fall 2025

Credit Hours: 3

Lecture Schedule: Page 7

Course Coordinator:

Abdullah Al Maruf, Ph.D., M.Pharm., B.Pharm. [AM]

Assistant Professor, College of Pharmacy, University of Manitoba

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Web: <https://www.maruf-lab.org>

Office Hours: There are no specific office hours. Please contact Dr. Maruf, preferably by email, for any course-related questions or concerns. During weekdays, emails are normally responded to within 24 hours, and meetings (virtual or in-person) are scheduled as needed.

Guest Instructor:

Sheryl Zelenitsky, PharmD, BSc (Pharm) [SZ]

Professor, College of Pharmacy, University of Manitoba

Office – 323, Apotex Centre

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Teaching Assistant:

Md. Abdul Aziz, M.Pharm., B.Pharm. [AA]

PhD Student, Vanier Scholar

College of Pharmacy, Apotex Centre

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Traditional Territories Acknowledgement:

The University of Manitoba campuses are located on original lands of Anishinaabeg, Ininiwak, Anisininewuk, Dakota Oyate and Dene, and on the National Homeland of the Red River Métis.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of Reconciliation and collaboration.

Purpose of the Course:

The course aims to provide professional pharmacy students with a comprehensive theoretical foundation of biopharmaceutics (the study of the chemical and physical properties of drugs, their components, and their activities in the absorption, distribution, and elimination processes) and pharmacokinetics (the study of the kinetics of drug absorption, distribution, metabolism, and excretion, ADME). In the first part of the course, students will learn basic concepts of biopharmaceutics and their application in drug product design and selection. In the second part, students will learn fundamental human pharmacokinetic concepts and develop skills in using pharmacokinetics to calculate dosage regimens and therapeutic drug monitoring for patients. The knowledge gained through this course will prepare students for subsequent courses (e.g., Clinical Pharmacokinetics and Clinical Therapeutics courses), experiential rotations, and ultimately pharmacy practice.

Course Objectives:

Upon successful completion of this course, students will be able to:

1. Describe various factors (e.g., physiologic, physiochemical, dosage form, pathophysiological) affecting a drug's absorption, distribution, and elimination (metabolism and excretion) from the human body.
2. Explain the theory underlying various pharmacokinetic parameters and concepts.
3. Calculate various pharmacokinetic parameters by applying compartment modelling and model-independent methods.
4. Calculate and adjust a patient's dosage regimen using biopharmaceutics and pharmacokinetic principles to keep serum/plasma drug concentrations within a desired therapeutic window.
5. Describe the clinical use of biopharmaceutics and pharmacokinetic concepts in optimal patient care.

Assumed Background:

Students should have a knowledge base in chemistry, biochemistry, physiology, pharmacology, and pharmaceutics. Students should be able to search the literature and locate relevant pharmacokinetic data from various sources. Students should also be able to use their calculators for linear regression and other pharmacokinetic calculations.

***Teaching and Learning Methods:**

Course Format: Two 90-minute weekly lectures will be used to introduce materials and apply knowledge in an active and reflective learning environment.

Class Time: Didactic Lecture (~60 mins) and Active Sessions (~20 mins).

*Guest instructors may have a different style and expectations.

Points to Remember:

- Students should take notes from lectures. **Lecture slides** and **reading (mandatory and supplemental) materials** will be posted on UM Learn before the lecture so that students can take notes on the slides. Some materials will be **mandatory “self-study”** materials that students must complete independently. Students should also supplement these **materials with relevant chapters from the main textbook** recommended for this course.
- Active sessions will consist of multiple-choice questions, true/false questions, calculations, patient cases, short-answer questions, and group activities on course materials presented in the previous and current lectures. **Active session materials** will be posted within 24 hours after the class. Students should expect similar types of questions during their examinations. Guest lecturers may have a different style and expectations.
- Students are encouraged to participate in active sessions for optimal teaching and learning.
- Students are encouraged to ask questions in class or one-on-one (virtual or in-person) by appointment.
- A basic, non-programmable, non-graphing calculator is required and the only device permitted in exams. Semilog graph paper is needed for specific calculations.

Student Attendance and Absences:

Please refer to the PharmD Student Handbook Sections 5.6 (Attendance at Class) and 5.7 (Procedures for Brief and Temporary Student Absences). When required (as per Section 5.7), the University Self-Declaration Form can be accessed at:

<https://umanitoba.ca/sites/default/files/2022-09/Self%20Declaration%20Fillable%20Form-%20FINAL%20for%20Website.pdf>

Students should submit the form, at their earliest convenience, to the Course Coordinator and copy: PharmD.Academics@umanitoba.ca

Course Technology:

It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical, and legal manner. Students can use all technology in classroom settings only for educational purposes approved by the instructor and/or the University of Manitoba Student Accessibility Services. Students should avoid using online and offline electronic technology (e.g., e-mail, text, social media, or gaming) for personal reasons. Course materials will be provided on UM Learn and can be accessed electronically.

Voluntary Withdrawal:

Course feedback and assessment will be provided before the voluntary withdrawal (VW) date. For the 2025-2026 academic year of the Pharmacy program, the VW date for this course is **November 3, 2025**. Please note that students contemplating voluntarily withdrawing from a course should speak to the Dean's office before doing so. There are significant consequences of withdrawing from a course during the professional program.

Academic Integrity (Plagiarism, Cheating, and Personation):

Please review the official College of Pharmacy Policies on Plagiarism and Cheating, clearly outlined in your Pharmacy Student Handbook and the University of Manitoba Academic Calendar at:

<https://www.umanitoba.ca/registrar/academic-calendar>

*The course coordinator (and instructors/guest lecturers) and the University of Manitoba hold copyright over the course materials, presentations, and lectures of this course. Course materials (both paper and digital) are for your **private study, research, and education** as per the fair-dealing exemption in the Copyright Act. No audio or video recording of lectures or presentation materials is allowed in any format, openly or surreptitiously, in whole or in part, unless approved as part of the accommodation request. Uploading or mass-distributing course materials for self-study, commercial, or altruistic purposes is not permitted on any platforms, including artificial intelligence (AI) platforms.*

Student Accessibility Services (SAS):

If you are a student with a disability, please contact SAS for academic accommodation supports and services. Students who have, or think they may have, a disability (e.g., mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation. The coordinator of this course is willing to meet with students to discuss accommodation recommended by SAS.

Student Accessibility Services <http://umanitoba.ca/student/saa/accessibility/>
520 University Centre, 204-474-7423. Student_accessibility@umanitoba.ca

Student Support:

Please refer to the attached Schedule “A” for a list of students’ supports provided by the University of Manitoba.

Assessment Program:**Assessment Criteria:**

Two-term tests (each 80 minutes) and the Final Exam (170 minutes) will be administered in person and will be paper-based. The exams will include multiple-choice questions, true/false questions, short-answer questions, patient case analyses, and pharmacokinetic calculations.

IMPORTANT: Incorrect answers on calculations that require a specific dose calculation for patients will result in no marks for that question. There will be no “partial marks” for an incorrect or inappropriate dose given to a patient.

Exam grades will be posted on UMLearn, whereas the final course letter grades will be entered into Aurora.

Assessment and Grading: Term Test I (30%, 80 mins, contents from Sep 3 – Sep 24), Term Test II (30%, 80 mins, contents from Oct 1 – Oct 29), Final Exam (40%, 170 mins, contents from Sep 3 – Oct 29).

Assessment Policies: Please consult the University of Manitoba's Undergraduate Calendar and the College of Pharmacy Student Handbook for specific regulations regarding academic dishonesty, attendance, examinations, and scholastic progress.

Grading:

> 90	A+
80 - 89	A
75 - 79	B+
70 - 74	B
65 - 69	C+
60 - 64	C
50 - 59	D
< 49	F

Note: All students are required to make themselves available for lectures and exam periods as indicated in the university general calendar, the College of Pharmacy exam timetable, the student handbook, and the course outline. Deferred exams will not be granted to accommodate vacations. **Only illness, bereavement, or exceptional compassionate circumstances will be considered for deferred exams.** Students participating in the University of Manitoba-sanctioned sports teams (Bison Sports) should discuss arrangements with the Dean's office and the course coordinator.

For missed term exams, students must notify the course coordinator as soon as possible. For missed final exams, students must notify the course coordinator and the Dean's Office. Deferred final exams require approval from the Dean's Office to be rescheduled.

Recommended Texts and Course Materials:

Mandatory Reading: Ducharme MP & Shargel L (Eds.). (2022). Shargel and Yu's Applied Biopharmaceutics and Pharmacokinetics, 8e. McGraw-Hill.

<https://accesspharmacy-mhmedical-com.uml.idm.oclc.org/content.aspx?bookid=3127§ionid=264437548>

Students will be provided with the following course materials:

- 1) Lecture slides and active session notes.
- 2) Reading materials (mandatory and supplemental), including mandatory "self-study" topics.
- 3) Relevant chapters from the recommended textbook for mandatory reading.

Meeting Educational Outcomes:

Course Objectives PHMD 2006 At the completion of this course, the student should be able to:	AFPC Educational Outcome Achieved	NAPRA Competency Achieved	CPSI Competency Domain	Learning Level (ICE – Ideas, Connections, Extensions)	Performance Level (Novice, Functional, Competent)
1. Describe factors affecting drug ADME	SC1.2 SC3.1 SC4.1	1.2	2.3	Ideas	Novice
2. Explain the concepts of drug interactions as they relate to biopharmaceutics and pharmacokinetic	SC1.2 SC3.1 SC4.1	1.2	2.4	Connections	Novice
3. Discuss the theory underlying pharmacokinetic rate constants, protein binding, drug extraction, blood flow	SC1.2 SC3.1 SC4.1	1.2	2.5	Ideas	Novice
4. Evaluate blood drug concentrations following drug administration for a one and two compartment model and from urinary excretion data for a one-compartment open model	SC1.2 SC3.1 SC4.1	1.3	5.2	Connections	Functional
5. Calculate dosage regimes for achieving specific peak and trough drug blood concentrations following IV bolus, IV infusion, or oral dosage form administration, loading doses, steady-state blood concentrations	SC1.2 SC3.1 SC4.1	1.2 1.3 2.2	5.4	Connections	Functional
6. Compare the concepts of non-linear versus linear pharmacokinetics	SC1.2 SC3.1 SC4.1	1.2 1.3	2.3	Ideas	Novice

* AFPC Outcomes at http://www.afpc.info/system/files/public/AFPC-Educational%20Outcomes%202017-Final_Jun4-17.pdf

* NAPRA Competencies at <https://www.napra.ca/wp-content/uploads/2024/10/NAPRA-Entry-to-practice-Competencies-October-2024-EN.pdf>

* CPSI Competencies https://www.patientsafetyinstitute.ca/en/toolsResources/safetyCompetencies/Documents/CPSI-SafetyCompetencies_EN_Digital.pdf

LECTURE SCHEDULE

Day/Time: Wednesday (W) 1:30 PM – 3:00 PM, Friday (F) 11:00 AM – 12:30 PM

Location: 164 Apotex

DATE	DAY	TIME	TOPICS	INSTRUCTOR	*CHAPTERS
Sep 3	W	1:30 – 3:00	Introduction to Biopharmaceutics and Pharmacokinetics	AM	1,2
Sep 5	F	11:00 – 12:30	Drug Absorption I	AM	4
Sep 10	W	1:30 – 3:00	Drug Absorption II	AM	4
Sep 12	F	11:00 – 12:30	Drug Absorption III	AM	4,7
Sep 17	W	1:30 – 3:00	Drug Distribution and Protein Binding I	AM	5
Sep 19	F	11:00 – 12:30	Drug Distribution and Protein Binding II	AM	5
Sep 24	W	1:30 – 3:00	Tutorial Class	AM/AA	-
Sep 26	F	11:00 – 12:20	Term Exam I (80 mins, 30%, Materials: Sep 3 – 24)	In-Person Exam, Paper-Based Apotex 164	
Oct 1	W	1:30 – 3:00	Drug Elimination I	AM	6
Oct 3	F	11:00 – 12:30	Drug Elimination II	AM	6
Oct 8	W	1:30 – 3:00	Bioavailability & Bioequivalence	AM	8
Oct 10	F	11:00 – 12:30	Introduction to PK/PD Models and Analyses	AM	1,11,15
Oct 15	W	1:30 – 3:00	One Compartment Model	AM	12
Oct 17	F	11:00 – 12:30	Multicompartment Models	AM	13
Oct 22	W	1:30 – 3:00	PK Practice Calculations	AM	1,11-13,15
Oct 24	F	11:00 – 12:30	Introduction to Intravenous Infusion	AM	14
Oct 29	W	1:30 – 3:00	Tutorial Class	AM/AA	-
Oct 31	F	11:00 – 12:20	Term Exam II (80 mins, 30%, Materials: Oct 1 – 29)	In-Person Exam, Paper-Based Apotex 164	
Nov 5	W	1:30 – 3:00	Introduction to Nonlinear Pharmacokinetics	AM	18
Nov 7	F	11:00 – 12:30	Special Population & Personalized Medicine	AM	21,24
Fall Term Break (Nov 10 – 14)					
Nov 19	W	1:30 – 3:00	Principles and Clinical Application of PK/PD	SZ	-
Nov 21	F	11:00 – 12:30	Predicting and Calculating Individualized PK in Patients	SZ	-
Nov 26	W	1:30 – 3:00	Intermittent, Multiple-Dosing Regimens	SZ	-
Nov 28	F	11:00 – 12:30	Continuous Infusion Regimens	SZ	-
Dec 5	F	1:00 – 4:00	Final Exam (170 min, 40%, Materials: Sep 3 – Nov 28)	In-Person Exam, Paper-Based Room 071	

***Textbook:** Ducharme MP & Shargel L (Eds.). (2022). Shargel and Yu's Applied Biopharmaceutics and Pharmacokinetics, 8e. McGraw-Hill [Available on Access Pharmacy].

Class Time (~90 mins): Didactic Lecture (~60 mins) with Active Sessions (~20 mins).

In exceptional circumstances, lectures will be delivered via Zoom. Any unavoidable schedule changes will be announced in class and posted on UM Learn.