

BIOC 3991 A: Toxicology

Fall 2013

General course information

Instructor: Dr. Christopher Anthony Dieni
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Classroom: Dunn 108 (Mini-Wu)
Class time: MWF 10:30 – 11:20 AM

This course investigates the biochemical aspects of toxicology in animals, up to and including humans. The course will begin by defining some of the basic principles and concepts important to establish a baseline understanding of toxicology. Following this, the disposition of a toxin will be investigated; the routes of entry of a toxin into an animal (Absorption), the circulation of that toxin throughout various fluidic systems and tissues (Distribution), and its elimination from the body (Excretion). Considerable time will be spent studying the reaction of parent toxins with detoxification enzymes to produce inactivated toxic metabolites or, in some cases, activated toxic metabolites (Metabolism or biotransformation; collectively known alongside Absorption, Distribution, and Excretion as “ADME”). Following this, the mechanisms of action of the parent toxins or toxic metabolites on specific cellular processes will be explored. Finally, examples of known toxins affecting specific organs or physiological processes (e.g. the liver, immune system, neurons, etc.) will be outlined.

Text

The required text for this course is Casarett & Doull's *Essentials of Toxicology*, 2nd edition, by Curtis D. Klaassen and John B. Watkins, 2010, ISBN-10 0071622403. Currently, the Mount Allison bookstore has 55 copies available but only 12 of those 55 are new; the rest are used.

Price for the 12 new books	\$78.96
Price for the 43 used books	\$59.22

Alternatively, new (and used) books may also be available from sellers such as Amazon.ca for \$75.82 (price of new books including tax and FREE Super Saver Shipping; <http://www.amazon.ca/dp/0071622403>), and from other distributors.

Additionally, some material will come from the non-required, more “hardcore” text, Casarett & Doull’s *Toxicology: The Basic Science of Poisons*, 8th edition, by Curtis D. Klaassen, 2013, ISBN-10 0071769235. In a nutshell, *Toxicology: The Basic Science of Poisons* is a way more advanced version of *Essentials of Toxicology*, and is even written by one of the same authors (Curtis D. Klaassen). *Toxicology: The Basic Science of Poisons* even contains the same figures and some verbatim text from *Essentials of Toxicology*, but is >200% longer and contains much more complex material. Any figures or material used from this text will be provided to you; that said, if you foresee toxicology as being an important part of your long-term future (e.g. graduate school in toxicology, professional schools such as medicine, pharmacology, etc.), this may be a good investment as it is an excellent and very up-to-date (published May 29th, 2013) resource. However, it is not cheap, and will cost you anywhere from \$78.66 to \$138.13 from Amazon.ca or elsewhere depending on Kindle version, used or new version from independent sellers, or new version from Amazon (tax and shipping not included; <http://www.amazon.ca/dp/0071769234>).

Moreover, at times, material may also come from the peer-reviewed literature, which will once again also be provided to you.

Assessment

Course component	Weight	Date
Assignments	20%	Various; 5 assignments worth 4% each, spread over the semester
Midterm #1	20%	Wednesday, October 9 th , 10:30-11:20 AM (normal class time)
Midterm #2 <u>cumulative</u>	20%	Wednesday, November 13 th , 10:30-11:20 AM (normal class time)
Presentation	10%	Must be uploaded by 5:00 PM, Friday, November 22 nd
Take-Home Final Exam	30%	Will be handed out Monday, December 2 nd , 10:30-11:20 AM (normal class time)

There will be no shuffling or reorganization of this assessment, e.g. you will not be able to have the better of your midterms count for combined weight, etc.

Grading scheme

Effective as of July 1st, 2013, all courses in the Faculty of Science now follow a single standardized grading scheme, in accordance with Article 10.9.3 in the Academic Calendar.

Description	GPA equivalent	Letter grade	Percentage
Outstanding	4.3	A+	90-100
Excellent	4.0	A	85-89
Very good	3.7	A-	80-84
Good	3.3	B+	77-79
	3.0	B	73-76
	2.7	B-	70-72
Satisfactory	2.3	C+	67-69
	2.0	C	63-66
	1.7	C-	60-62
Conditional (non-continuing) pass	1.3	D+	57-59
	1.0	D	53-56
	0.7	D-	50-52
Failure	0.0	F	0-49

Presentations

At a teaching-centric, primarily-undergraduate university such as Mount Allison, an important part of learning in 3rd and 4th-year courses is to work on an independent project; to have a component of the course that is unique to the individual student, in contrast to midterms or final exams which may be the same for all students. However, large class sizes (50+ students) make this challenging. For instance, even a strictly-timed 10-minute class presentation with no Q&A afterward would barely accommodate 5 students per lecture period; for a class of 50 students, it would take 10 lecture periods (or roughly 3 weeks) just to get through exceedingly-short 10-minute presentations for everyone. Additionally, this would also cause the semester to be “rushed” simply to have enough class-time to accommodate all presentations.

To preserve the independent quality that goes with a 3rd-year course, yet not rush through the semester and not be bogged down with presentations for a month (or more), students will deliver individual presentations of 12-minute length via recorded video, which students must upload to an online platform not requiring a login or password (YouTube is likely your best bet), in order for the instructor and all classmates to freely access and view.

Presentation topics will be assigned, and students will be notified of their topic during the week of September 16th. In order to promote integration between coursework and research over a student’s academic degree, any students engaged in research (for an honours thesis or otherwise) are strongly-encouraged to discuss the nature of their

research with the instructor; assigned topics for those students will relate to their research yet will be somewhat different and not entirely overlap with it, in order to retain elements of challenge and fairness for all students. Additionally, because of the limitations of material that can be covered over a single-semester course, and because of the broad diversity of ongoing research projects at Mount Allison and elsewhere, every effort will be made to link teaching and research, but some students' assigned topics may only have a weak link to their research at best.

Presentations must be uploaded and a permalink provided to the instructor by 5:00 PM on Friday, November 22nd. By this point in the course, both midterms will have been completed. There will be no more assignments due between November 25th and December 2nd. Classes will not be held in between November 25th and 29th, inclusive. Thus, students will be expected to invest the time required to view **all** of each other's presentations between November 23rd (by which point all students' presentations will be uploaded) to December 1st (the day before the final day of class).

Tentative list of topics to be covered, and order

Subject to change; this list may be adjusted based on real-time assessment of the course and student performance.

Topic	Source
Principles of toxicology and mini-case studies	<i>Essentials of Toxicology</i> chapter 2; headline news; peer-reviewed literature
Absorption, Distribution, and Excretion (ADE)	<i>Essentials of Toxicology</i> chapter 5; <i>Pharmacology</i> 4 th edition by Brenner and Stevens chapter 2
Case Study I: Alcohol – Bridging the ADE and M components of ADME	<i>Essentials of Toxicology</i> chapters 5 and 6; headline news; videos
Metabolism (a.k.a. Biotransformation)	<i>Essentials of Toxicology</i> chapter 6; likely many other sources (TBD)
Case Study II: Inactivation and activation of aflatoxin – Bridging ADME and mechanisms of toxicity	<i>Essentials of Toxicology</i> chapter 6; peer-reviewed literature
Disposition of non-xenobiotic toxicants	Excerpts from several chapters of <i>Essentials of Toxicology</i> and <i>Toxicology: The Basic Science of Poisons</i>
Midterm #1 – includes all material taught up to Friday, October 4th	
Mechanisms of toxicity	Chapter 3 of both <i>Essentials of Toxicology</i> and <i>Toxicology: The Basic Science of Poisons</i>
Case Study III: Algal blooms and algal toxins – Ecotoxicology, comparative physiology and mechanisms of toxicity	<i>Essentials of Toxicology</i> chapter 3; headline news; peer-reviewed literature
Case Study IV: Bee venom and cellular damage – Toxicity on the cellular macroscale	Excerpts from several chapters of <i>Essentials of Toxicology</i> and <i>Toxicology: The Basic Science of Poisons</i> ; headline news; peer-reviewed literature
Case Study V: Metal poisoning – Bridging mechanism of toxicity and nonacute toxicity	
Carcinogenesis and mini-case studies	Chapter 8 of both <i>Essentials of Toxicology</i> and <i>Toxicology: The Basic Science of Poisons</i> ; headline news; peer-reviewed literature
Genotoxicity and mini-case studies	Chapter 9 of both <i>Essentials of Toxicology</i> and <i>Toxicology: The Basic Science of Poisons</i> ; headline news; peer-reviewed literature
Developmental toxicity and mini-case studies	Chapter 10 of both <i>Essentials of Toxicology</i> and <i>Toxicology: The Basic Science of Poisons</i> ; headline news; peer-reviewed literature

Midterm #2 – cumulative and includes all material taught up to Friday, November 8th

Full case studies: toxicology from parent toxin to target

Excerpts from several chapters of *Essentials of Toxicology* and *Toxicology: The Basic Science of Poisons*; headline news; peer-reviewed literature

Student online video presentations

Take-Home Final Exam – includes all material from the entire course
