Mechanistic Toxicology Syllabus
Biology 579
Summer 2022
May 9-27, 2022

Course: Mechanistic Toxicology- Biology 579-M75
Language: English
Tine Zone: Central
Meeting Times: This is a web course. Materials will be delivered via computer. Students who are officially enrolled in this course should be able to access the course at: The dropdown menu (Blackboard) from www.wku.edu homepage.

Students will need to log-in to the WKU Blackboard system using the first part of their NET ID and their WKU email password as the password. If you have difficulty, the WKU support Line is 270-745-7000 OR you can email the blackboard help at bbhelp@wku.edu (please include your full name, WKU ID #, course ID, and instructor's full name).

Contact Information/emails: Dr. Kerrie McDaniel
Office: KTH 3045
Email: Kerrie.mcdaniel@wku.edu
Emails will be answered 8:00-5:00 on weekdays.
Office Hours: by appointment

Required Materials (provided):
A Textbook of Modern Toxicology, 4th Edition, **Ed. Ernest Hodgson, 2010. A pdf version of this text will be provided FREE OF CHARGE via Blackboard.**

In addition, we will be using primary literature that will be provided via Blackboard.

Optional Materials:
- Casarett & Doull's *Toxicology, The Basic Science of Poisons*, 8th Ed.,Edited by Curtis D. Klaasen, McGraw-Hill Publishing, 2013.
- *Mechanistic Toxicology, The Molecular Basis of How Chemicals Disrupt Biological Targets, U.A. Boelsterli,* CRC Press, Taylor & Francis Group, 2007.

Ability to use technology: The ability to use technology is required. This is a web course where all material will be delivered via computer. Use of technology is absolutely REQUIRED to take this course. If you are uncomfortable using technology then you should choose a different course.

Overview: Mechanistic Toxicology is a multidisciplinary course that looks at how chemicals disrupt homeostasis of cells. It brings together anatomy and physiology, basic biological concepts, and biochemistry to understand why chemicals can serve as therapeutic agents or act as toxicants.

Goals: The general goals of this course are:
Students will have an understanding of:
1. Basic principles in toxicology including dose/response, toxic effects, Toxicokinetics (absorption, translocation, biotransformation & excretion).

2. Basic mechanisms of how xenobiotics exert their toxic effects in living organisms.
3. How the body adapts to xenobiotics in an attempt to maintain homeostasis

Objectives:

Students will be able to:

1. Use government websites to gain information about toxic substances.
2. Describe how toxicants enter the body, are metabolized, distributed and excreted from the body.
3. Describe biological adaptations to cellular stress and types of toxic responses.
4. Discuss organ-selective, species selective, etc. differences in toxic effects.
5. Differentiate between types of cellular transport and their roles in accumulating xenobiotics.
6. Discuss bioactivation and detoxification of Xenobiotics during metabolism and biotransformation.
7. Differentiate between mechanisms resulting in bioactivation vs detoxification.
8. Differentiate between Phase I and Phase II mechanisms.
9. Describe Reactive Oxygen Species and their role in toxicity.
10. Explain the toxicological consequences of oxidative stress.
11. Discuss mechanisms that interfere with antioxidant stress.
12. Describe how mechanisms of oxidative stress affecting signaling, gene regulation and cell injury.
13. Discuss the role of Calcium in maintaining cellular homeostasis and mechanisms of toxicity by disruption of this process.
14. Differentiate between Genotoxic and Non-genotoxic xenobiotics in promoting carcinogenesis.
15. Compare toxic mechanisms of Cell Proliferation vs Tissue Repair
16. Explain normal mitochondrial function and how this could be impaired via xenobiotics.
17. Describe mechanisms within the mitochondria that are susceptible to xenobiotic insult and the effects that result from toxic injury.

Topics Will Include:

- Basic Review/Introduction to General Toxicology
- Resources (government/community/educational) in the area of Toxicology
- Introduction to Mechanistic Toxicology
- Types of Toxic Responses and cellular adaptations to stress
- Transport Mechanisms and their effect on toxicity
- Biotransformation/Metabolism of Xenobiotics-Toxicokinetics
- Xenobiotic-Induced Oxidative Stress- ROS, Cell Injury, Signaling and Gene Regulation
- Disruption of Calcium Homeostasis
- Xenobiotic Impairment of Cell Proliferation and Tissue Repair-including carcinogenesis
- Xenobiotic-Induced Energy Stress- Damage to Mitochondria

Grading: Your grades will be based on the average of the grades earned on assignments/quizzes, discussion boards and a final project. A standard grading scale will be used to assign grades.

Grading Scale:

A= 90-100%
B=80-89%
C=70-79%
D=60-69%
F= Below 60%

Tentative Assessment Table

Type of Assignment	Number of Assignments	Points/assignment	Total points
Homework Assignments	11	varies	433
Discussion Boards	2	50	100
Final Paper/Project	1	100	100
Final Exam	1	68	68
TOTAL			701

Remember: Grades are not given. We simply record the grade that you have earned.

Explanation of Assignments/Quizzes/Exams

- **Modules:** The course content for this course is organized into Learning Modules. You will find a Learning Module for each of the major topics in this course. Each module contain the materials we will use for that topic. Some topics will be scheduled for only one day while others, that are more complicated, may take several days. Watch your schedule to keep up with assignments.
- **Course Schedule:** Once you access the course in Blackboard, you will find a tab for "Schedule". This will contain a detailed schedule of every assignment and when they are due. You will also find announcements that will guide you through the course. Use this schedule as you guide. Do not get behind. Mechanistic Toxicology moves extremely fast in the summer.
- **Media Site Lectures/Videos:** There is at least one Media Site video for each module. The videos that I have prepared for you cover information that is summarized on the Power Point slides. We will be using the textbook and literature but these videos will give you the most direct source of pertinent information. Some will guide you through the modules so make sure that you watch the videos. Other videos are recorded lectures of eminent Toxicologists. These are designed to provide insight into the current and important research in Toxicology as well as introduce you to some of the big names in the field.
- **Reading:** The reading material is an important part of this class. The free text that I have provided via Blackboard is a general Toxicology text and so does not go into the detail that we will use in this course. It is a very good background, however, and is free. We will be supplementing the text with literature, the Media Site videos/Power Points, databases and websites, and the eminent Toxicologist series. If you wish to purchase a more thorough text, there are a couple of excellent optional texts listed.
- **Assignments/Quizzes:** You will have several assignments/quizzes through the semester. We will call them "assignments" because that sound less intimidating, but the assignments will serve the same function as an open-note quiz to assess your comprehension of the videos, readings, and other content in the class. Some of the assignments will be straight-forward questions over readings and videos to make sure that you do them. Others will require you to think critically, make connections and explain concepts.
- **Discussion Boards:** There are 2 Discussion Boards that you will participate in during the short semester. The guidelines for participation are posted in the same folder as the syllabus. Materials for each Discussion Board are provided. These may be a Case Study, primary literature, a video or a combination of all of these. Read/listen to the materials provided for each Discussion Board and respond to the Discussion Board prompts and/or to other student's comments. I do not expect you to just "answer the questions" posed in the prompt but want you to use these questions to spring-board

your discussion. You will need to comment *at least* 4 times on each discussion board with MEANINGFUL insights. These posts need to be separated by at least 24 hours. In other words, you cannot wait until the day before the Discussion is due and then make 4 comments. You need to be participating often throughout the week. The discussion board is one way we can interact about course material.

- **Final Exam:** This cumulative exam will require you to assimilate the information that we have used during the semester to answer questions regarding mechanisms of toxicology. You will be allowed to use your text, notes and other resources, but an understanding of the course content will be required to perform well on the exam. There will be a list of questions that you will get to select from for the exam.
- **Final Project:** The final project/paper is designed to allow you to assimilate all of the information on toxicological mechanisms we have learned this semester. You will choose one xenobiotic and use primary literature to write a paper or construct a Power Point presentation about its toxicity. A rubric for this paper/project is posted in Blackboard.

Academic Integrity and Misconduct: Don't cheat. Cheating is not only disrespectful (violating general policies) but it is also dishonest. Cheating on quizzes, exams or assignments will result in a failing grade for the course and could result in expulsion from the university. It is not worth it. Do your own work.

"*Dishonesty, such as cheating, plagiarism, misrepresenting of oneself or an organization, knowingly furnishing false information to the University, or omitting relevant or necessary information to gain a benefit, to injure, or defraud is prohibited*." WKU Student Conduct Code.

Deadlines: The University designated deadlines for withdrawal from a class or the university are firm. Credit for the course will not be changed to an audit after the university-designated time due to a poor grade in the class. Please make note of these dates. Dropping the class after the university deadline requires a written explanation by you and signatures from the Instructor, the department head and the dean of Ogden College. These exceptions are only granted in extreme circumstances. So ABIDE by the deadlines!

Other deadlines can be found at the following location:

https://www.wku.edu/registrationguide/

End of Semester Policies:

- There is no formal "extra credit" for the course. Do not ask. Study hard, do well on the tests and quizzes. However, if relevant campus activities such as seminar lectures related to A&P become available, I often make some extra credit available for students who participate.
- Grades are not completed until final grades are posted in TOPNET, so please do not email and ask if grades are finished. It takes time to get your lab grades integrated with lecture grades.
- The grading scale is posted on this syllabus. If you have an 89.45876, then you are guaranteed at least a B in the course. If grades are not posted in TOPNET, then they are not complete (see above bullet), so please do not email and ask if there is "rounding up". You will know if any adjustments were made when grades are posted on TOPNET. Emails asking about "rounding up" or about what final grades will be until after they are posted in TOPNET will be ignored.
- There is absolutely no "making up" missed homework assignments.

Blackboard Entry

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www.wku.edu (choose "Blackboard" from the pull down menu)

Family Educational Rights and Privacy Act:

Due to the Family Educational Rights and Privacy Act (FERPA), if you are 18 years old or older, I cannot discuss your grades, etc. with your parents or anyone else outside the necessary university academic community without your written permission.

Student Disability Services

In compliance with university policy, students with disabilities who require accommodations (academic adjustments and/or auxiliary aids or services) for this course must contact the Office for Student Disability Services in DUC A-200 of the Student Success Center in Downing University Center. Please DO NOT request accommodations directly from the professor or instructor without a letter of accommodation from the Office for Student Disability Services.

Title IX: Sexual Misconduct/Assault Policy (#0.2070) and Discrimination and Harassment Policy (#0.2040). Discrimination, harassment and/or sexual misconduct based on sex/gender are prohibited. If you experience an incident of sex/gender-based discrimination, harassment and/or sexual misconduct, you are encouraged to report it to the Title IX Coordinator, Andrea Anderson, 270-745-5398 or Title IX Investigators, Michael Crowe, 270-745-5429 or Joshua Hayes, 270-745-5121