



## **PubH 3014**

### **Environmental Health Effects: Introduction to Toxicology Spring 2019**

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<b>Credits:</b>	2
<b>Meeting Days:</b>	Wednesdays
<b>Meeting Time:</b>	3:30 P.M. – 5:20 P.M.
<b>Meeting Place:</b>	Bruininks 420A
<b>Instructor:</b>	Elizabeth Wattenberg, Ph.D. Associate Professor, Division of Environmental Health Sciences
<b>Office Address:</b>	1110 Mayo
<b>Office Phone:</b>	612-626-0184
<b>E-mail:</b>	watte004@umn.edu
<b>Office Hours:</b>	e-mail to make an appointment

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#### **I. Course Description**

This course is designed for students who are interested in public health and environmental issues. Toxicology is a multidisciplinary experimental science that combines chemistry, biology, and physiology to determine whether substances we are exposed to in the environment are likely to harm our health. Students will learn how toxicology is used to understand how our internal environment determines how the external environment affects our health. In addition, students will learn how toxicology is applied to protect human health through safety evaluation.

#### **II. Course Prerequisites**

Previous coursework in biology and chemistry is required. Biochemistry is recommended. Students should be able to analyze data, know the basic components of mammalian cells, recognize basic chemical structures including functional groups, and understand the basic functions of DNA, enzymes and other proteins, and lipids.

### III. Course Goals and Objectives

By the end of the semester, students will be able to do the following:

- Explain the basic principles of toxicology, including dose-response, the fundamental design elements of toxicology studies, and the physiological processes that determine the fate of chemicals in the body.
- Apply the basic principles of toxicology to evaluate the risk that exposure to chemicals in the environment will cause toxicity and disease in humans.
- Explain how personal characteristics, such as diet and genetics, affect how individuals respond to environmental toxicants.
- Retrieve toxicology information from public health effects databases, interpret the information, and use scientific evidence to explain the roles of environmental toxicants in human disease.
- Solve problems, such as interpreting data to determine the dose of a chemical that is likely to be toxic to humans versus a dose that is not likely to be toxic to humans, and determining why a chemical is nontoxic to one species, such as mice, but is toxic to a different species, such as humans.
- Present environmental health issues to an educated audience.

### IV. Methods of Instruction and Work Expectations

The course includes lectures, in-class exercises, quizzes, a written report, and an oral presentation. Grading percentages are based on total performance on the activities, quizzes, and assignments. Extra credit projects will not be accepted to improve a grade or as a substitute for class participation or assignments. The curve may be adjusted depending on the overall performance of the class (*Grading Criteria* are explained later in the syllabus).

**Please note:** Students are expected to complete the reading assignments and review of the online materials before each class. The work outside of class will help prepare you for the work that will take place in the classroom. The lectures will not cover all of material in the outside reading. **Lecture notes will not be distributed to the class.** The in-class activities will draw on knowledge from both the reading and review of materials outside of class and the lectures given in class.

#### Learning Community

Many of our courses ask students to work in teams or discussion groups. We do not come to our courses with identical backgrounds and experiences and building on what we already know about collaborating, listening, and engaging is critical to successful professional, academic, and scientific engagement with topics.

In this course, students are expected to engage with each other in respectful and thoughtful ways.

In group work, this can mean:

- Setting expectations with your groups about communication and response time during the first week of the semester (or as soon as groups are assigned) and contacting the instructor if scheduling problems cannot be overcome.
- Setting clear deadlines and holding yourself and each other accountable.
- Determining the roles group members need to fulfill to successfully complete the project on time.
- Developing a rapport prior to beginning the project (what prior experience are you bringing to the project, what are your strengths as they apply to the project, what do you like to work on?)

In group discussion, this can mean:

- Respecting the identities and experiences of your classmates.
- Avoid broad statements and generalizations. Group discussions are another form of academic communication and responses to instructor questions in a group discussion are evaluated. Apply the same rigor to crafting discussion posts as you would for a paper.
- Consider your tone and language, especially when communicating in text format, as the lack of other cues can lead to misinterpretation.

Like other work in the course, all student to student communication is covered by the Student Conduct Code (<https://z.umn.edu/studentconduct>).

Course grades will be determined by the following:

- A. Quizzes (20%)
- B. In-class activities (20%)
- C. Course project (60%)

**A. Quizzes (20%)**

There will be four quizzes (5 points per quiz). The quizzes will be based on the readings and other online materials. They are intended to make sure that all students understand the basic terms and concepts described in the readings and other online materials so that all students are prepared for the in-class activities. The dates of the quizzes are listed below. The dates may change, depending on the pace of the class. Students will be notified if there is a change in quiz dates.

- Quiz 1: February 6
- Quiz 2: February 27
- Quiz 3: March 27
- Quiz 4: April 17

**B. In-class activities (20%)**

Most class periods will include time for in-class activities. The purpose of the in-class exercises is for you to apply what you have learned to analyze data and solve problems. These exercises will apply both the knowledge you gain from reading and reviewing materials outside of class, and from knowledge you gain from short lectures in class.

**C. Course project (60%)**

The purpose of this assignment is to apply your knowledge of toxicology to a current issue that has been highlighted in the popular press, and that involves humans being exposed to chemicals in the environment. The goal of this project is for you to gain experience finding, analyzing, and delivering scientific evidence that you will use to determine if a public claim or concern regarding the role of a chemical in harming human health is valid. This assignment is explained in detail on a document posted on the Moodle site and will also be described in class. The major products of this project are a report and a presentation that explains the issue, the scientific evidence on the chemical, your analysis of the scientific evidence, and your conclusions regarding whether the claim being made in the article is valid.

You have the option of working on the course project either by yourself or with a partner. If you choose to work with a partner, you will need to explain how each of you contributed equally to the course project.

**Makeup Work for Legitimate Absences.** Makeup activities will be provided for students who miss assignments because of scheduled activities of an official University student organization, a religious holiday, a verifiable illness, a serious family emergency, jury duty or subpoenas. To be eligible for makeup assignments, the student must notify the instructor before the scheduled day of the assignment and provide documentation that verifies the reason for the absence. If you have a scheduled activity on a class date, notify the instructor immediately. Students must make up work within one week of the date of the original assignment.

**Please note:** All students are required to attend all the class presentations on April 24 and May 1.

**Grading policy on submissions of assignments after the deadlines**

- No credit will be given for in-class activities that are not submitted during the class period.
- Other assignments: 2 points will be deducted for each day that the assignment is submitted past the deadline. For example, if an assignment is due by 5:00 pm on a Friday, 2 points will be deducted if the assignment is turned in after 5:00 pm. Four points will be deducted if the assignment is turned in after 5:00 pm on Saturday, etc.

## Use of Personal Electronic Devices in the Classroom

There are times during the class period where you will need an electronic device, preferably a laptop, to search for information. There will also be other times where you will be required to work without electronic devices, and you will be asked to close the electronic devices or put them away.

## V. Course Text and Readings

The readings and other materials for this course are all available electronically through the Bio-Med Library or they are materials available to the public online. It is difficult to find one good introductory toxicology textbook. This course takes advantage of the excellent resources available through the U of M libraries and online to provide selected reading material and other resources at no cost to students. The readings are listed under each class in the Course Outline/Weekly Schedule section.

The readings and other online materials can be found at <https://reserves.lib.umn.edu/>

The readings and other online materials are also available through the Moodle site. Go to the *Access course readings* link under the *Library Resources* block to access the E-reserve page for this course.

**Please note:** Students are expected to complete the readings and review of other online materials before each class.

### Resources:

Below is a website that is a glossary that is a useful resource for common terms that are used in toxicology. This glossary may be useful for defining terms in textbooks and journal articles.  
<http://sis.nlm.nih.gov/enviro/iupacglossary/glossary.html>

Textbooks and reference books available online through the Biomed Library:

<https://hsl.lib.umn.edu/biomed>

An Introduction to Toxicology by Philip C. Burcham

Principles and Methods of Toxicology, Sixth Edition, Edited by A. Wallace Hayes

### Other online resources:

Toxicology Tutor I, National Library of Medicine  
<http://sis.nlm.nih.gov/enviro/toxtutor/Tox1/amenu.htm>

Toxicology Tutor II, National Library of Medicine  
<http://sis.nlm.nih.gov/enviro/toxtutor/Tox2/amenu.htm>

Environmental Health News  
<http://www.ehn.org> or  
<http://www.ehn.org/toxics/>

## VI. Course Outline/Weekly Schedule (the dates of the lectures and activities may be modified depending on the progress of the class)

<b>Wednesday, January 23:</b> <i>Introduction to Toxicology: Prediction and Prevention</i>
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### Work outside class:

Reading: *An Introduction to Toxicology* by Philip C. Burcham, Chapter 1 The Emergence of Modern Toxicology. Pay particular attention to 1.3.1 Paracelsus, 1.6 The Discipline Emerges, 1.8 The Breadth of Modern Toxicology, and 1.9 The Scope of Modern Toxicology Research.

### Work in class:

Introductory lecture  
Explore *Environmental Health News*

**Assignments:** Submit top three choices for your Project topic; note whether you prefer to work alone or if you would like to work with a partner.

**Wednesday, January 30: Dose Response: The Dose Makes the Poison**

**Work outside class:**

Reading: *An Introduction to Toxicology* by Philip C. Burcham, Chapter 2. Core Concepts in Toxicology. Focus on Section 2.2. The Terminology of Toxicology, Section 2.4 The Localisation of Toxicity, Section: 2.5 Dose: The Magnitude of Exposure (note their definition of graded response and definition of threshold differs a bit from what you will hear in class), and Section 2.9: The Timing of Toxicity.

Review the slides shown on the website below under the section Toxicology Tutor I: Dose and Dose Response. Taking the quizzes included in this module is highly recommended.  
<http://sis.nlm.nih.gov/enviro/toxtutor/Tox1/amenu.htm>

**Work in class:**

Lecture on dose-response  
In-class activities to practice interpreting dose-response data

**Assignments:** Receive your Project topic

**Wednesday, February 6: Fundamentals of Toxicology Studies**

**Work outside class:**

Reading: *An Introduction to Toxicology* by Philip C. Burcham, Chapter 2. Core Concepts in Toxicology, Section 2.3 Chemical Exposure Scenarios.

*Principles and Methods of Toxicology*, Section III Methods, Chapter 24 Short-Term, Subchronic and Chronic Toxicology Studies by D. T Wilson et al.

Watch the Risk Bites YouTube video: *A New Way to Evaluate Chemical Safety - TOX21*  
<https://www.youtube.com/watch?v=vKhn1HRXgn8>

Review the slides shown on the website below under the section Toxicology Tutor I: Toxic Effects and Toxicity Testing Methods. Taking the quizzes included in this module is highly recommended.  
<http://sis.nlm.nih.gov/enviro/toxtutor/Tox1/amenu.htm>

**Work in class:**

Quiz 1  
Lecture on fundamentals of animal studies  
In-class activities to apply your knowledge of the design and interpretation of toxicology studies

**Wednesday, February 13: *Fundamentals of Toxicology Studies continued; Introduction to Health Effects Databases***

**Work outside class:**

Reading: *An Introduction to Toxicology* by Philip C. Burcham, Chapter 2. Core Concepts in Toxicology, Section 2.3 Chemical Exposure Scenarios.

*Principles and Methods of Toxicology*, Chapter 24 Short-Term, Subchronic and Chronic Toxicology Studies by N. H. Wilson et al.

Watch the Risk Bites YouTube video: *A New Way to Evaluate Chemical Safety - TOX21*  
<https://www.youtube.com/watch?v=vKhn1HRXgn8>

Review the slides shown on the website below under the section Toxicology Tutor I: Toxic Effects and Toxicity Testing Methods. Taking the quizzes included in this module is highly recommended.  
<http://sis.nlm.nih.gov/enviro/toxtutor/Tox1/amenu.htm>

**Work in class:**

Lecture on fundamentals of animal studies

In-class activities to apply your knowledge of the design and interpretation of toxicology studies

Practice searching for health effects information using different types of databases

**Bring a laptop to class.**

**Assignment:** Draft of *background* section of course project is due by the beginning of class. Submit to instructor by email.

**Wednesday, February 20: *Fundamentals of Toxicology Studies continued***

**Work outside class:**

Reading: *An Introduction to Toxicology* by Philip C. Burcham, Chapter 2. Core Concepts in Toxicology, Section 2.3 Chemical Exposure Scenarios.

*Principles and Methods of Toxicology*, Chapter 24 Short-Term, Subchronic and Chronic Toxicology Studies by N. H. Wilson et al.

Watch the Risk Bites YouTube video: *A New Way to Evaluate Chemical Safety - TOX21*  
<https://www.youtube.com/watch?v=vKhn1HRXgn8>

Review the slides shown on the website below under the section Toxicology Tutor I: Toxic Effects and Toxicity Testing Methods. Taking the quizzes included in this module is highly recommended.  
<http://sis.nlm.nih.gov/enviro/toxtutor/Tox1/amenu.htm>

**Work in class:**

Lecture on fundamentals of animal studies

In-class activities to apply your knowledge of the design and interpretation of toxicology studies

**Wednesday, February 27:** *The Application of Toxicology to Safety Evaluation and Risk Assessment: What is safe? Discuss what makes a good presentation*

**Work outside class:**

Review the slides shown on the website below under the section Toxicology Tutor I: Risk Assessment. Taking the quizzes included in this module is highly recommended. The section on Exposure Standards/Guidelines is optional.

<http://sis.nlm.nih.gov/enviro/toxtutor/Tox1/amenu.htm>

Watch the Risk Bites YouTube videos:

Hazard vs. Risk – Same Difference

<https://www.youtube.com/watch?v=VF-8QksiU7c>

What does “Probably Cause Cancer” actually mean?

<https://www.youtube.com/watch?v=CbBkB81ySxQ>

Review the Weight of Evidence classifications from USEPA and IARC posted on Moodle site

**Work in class:**

Quiz 2

Lecture on risk assessment methods

In-class activities to apply your knowledge of risk assessment

Discuss what makes a good presentation

**Assignment:** Draft of *exposure* section of course project is due by the beginning of class. Submit to instructor by email.

**Wednesday, March 6** *The Application of Toxicology to Safety Evaluation and Risk Assessment: What is safe? continued*

**Work outside class:**

Review the slides shown on the website below under the section Toxicology Tutor I: Risk Assessment. Taking the quizzes included in this module is highly recommended. The section on Exposure Standards/Guidelines is optional.

<http://sis.nlm.nih.gov/enviro/toxtutor/Tox1/amenu.htm>

Watch the Risk Bites YouTube videos:

Hazard vs. Risk – Same Difference

<https://www.youtube.com/watch?v=VF-8QksiU7c>

What does “Probably Cause Cancer” actually mean?

<https://www.youtube.com/watch?v=CbBkB81ySxQ>

Review the Weight of Evidence classifications from USEPA and IARC posted on Moodle site

**Work in class:**

Lecture on risk assessment methods

In-class activities to apply your knowledge of risk assessment

Discuss peer evaluation questions for course project presentations

**Assignment:** Draft of *health effects* section of course project is due by the beginning of class. Submit to instructor by email.

**Wednesday, March 13:** *The Internal Fate of Toxicants: Absorption, Distribution, and Excretion*

**Work outside class:**

After reviewing the materials listed below, you should understand the basic characteristics of the different mechanisms by which chemicals can be transported into and out of cells, and you should understand the basic characteristics of the different routes of exposure, and how these can affect the internal fate of toxicants.

Reading:

*An Introduction to Toxicology* by Philip C. Burcham, Chapter 3 Toxicokinetics: The Behaviour of Chemicals in the Body, sections 3.1 – 3.3.4, 3.6 – 3.8.

Review the slides shown on the website below under the section Toxicology Tutor II: Introduction, Absorption, Distribution, Excretion. Taking the quizzes included in this module is highly recommended.

<http://sis.nlm.nih.gov/enviro/toxtutor/Tox2/amenu.htm>

Watch the video: Diffusion, Facilitated Diffusion & Active Transport: Movement Across the Cell Membrane

<https://www.youtube.com/watch?v=UgN76naeA1Q>

Watch the video: Membrane Transport Animation

<https://www.youtube.com/watch?v=ovHYKIHYpyA>

**Work in class:**

Lecture on toxicokinetics

In-class activities to apply your knowledge of toxicokinetics

**Assignments:** Draft paper due to instructor by the beginning of class. Submit by email.

**Wednesday, March 20:** Spring Break

**Wednesday, March 27:** *The Internal Fate of Toxicants: Absorption, Distribution, and Excretion* continued

**Work outside class:** After reviewing the materials listed below, you should understand the basic characteristics of the different mechanisms by which chemicals can be transported into and out of cells, and you should understand the basic characteristics of the different routes of exposure, and how these can affect the internal fate of toxicants.

Reading:

*An Introduction to Toxicology* by Philip C. Burcham, Chapter 3 Toxicokinetics: The Behaviour of Chemicals in the Body, sections 3.1 – 3.3.4, 3.6 – 3.8.

Watch the video: Diffusion, Facilitated Diffusion & Active Transport: Movement across the Cell Membrane

<https://www.youtube.com/watch?v=UgN76naeA1Q>

Watch the video: Membrane Transport Animation

<https://www.youtube.com/watch?v=ovHYKIHYpyA>

**Work in class:**

Quiz 3

Lecture on toxicokinetics

In-class activities to apply your knowledge of toxicokinetics

**Wednesday, April 3: *The Internal Fate of Toxicants: Biotransformation/Metabolism***

**Work outside class:**

Reading: *An Introduction to Toxicology* by Philip C. Burcham, Chapter 3 Toxicokinetics: The Behaviour of Chemicals in the Body, sections 3.4 – 3.5.

Review the slides shown on the website below under the section Toxicology Tutor II on Biotransformation. Taking the quizzes included in this module is highly recommended.

<http://sis.nlm.nih.gov/enviro/toxtutor/Tox2/amenu.htm>

**Work in class:**

Lecture on metabolism/biotransformation

In-class activities to apply your knowledge of metabolism/biotransformation

Workshop drafts of paper

**Assignments:** Draft presentation due to instructor by the beginning of class. Submit the drafts by email.

**Wednesday, April 10: *The Internal Fate of Toxicants: Biotransformation/Metabolism continued***

**Work outside class:**

Reading: *An Introduction to Toxicology* by Philip C. Burcham, Chapter 3 Toxicokinetics: The Behaviour of Chemicals in the Body, sections 3.4 – 3.5.

Review the slides shown on the website below under the section Toxicology Tutor II on Biotransformation. Taking the quizzes included in this module is highly recommended.

<http://sis.nlm.nih.gov/enviro/toxtutor/Tox2/amenu.htm>

**Work in class:**

Lecture on metabolism/biotransformation

In-class activities to apply your knowledge of metabolism/biotransformation

Workshop draft presentations

**Wednesday, April 17: *The Internal Fate of Toxicants: Biotransformation/Metabolism continued***

**Work outside class:**

Reading: *An Introduction to Toxicology* by Philip C. Burcham, Chapter 3 Toxicokinetics: The Behaviour of Chemicals in the Body, sections 3.4 – 3.5.

Review the slides shown on the website below under the section Toxicology Tutor II on Biotransformation. Taking the quizzes included in this module is highly recommended.

<http://sis.nlm.nih.gov/enviro/toxtutor/Tox2/amenu.htm>

**Work in class:**

Quiz 4

Lecture on metabolism/biotransformation

In-class activities to apply your knowledge of metabolism/biotransformation

**Assignments:** Project paper due to the instructor by the beginning of class. Submit the paper to the instructor by email.

**Wednesday, April 24: *Project Presentations***

**Assignments:**

Peer evaluations of presentations due to the instructor by the end of class

**Assignments:** Peer evaluation of presentations due to the instructor by the end of class.

## **VII. Evaluation and Grading**

### **SPH AND UNIVERSITY POLICIES & RESOURCES**

The School of Public Health maintains up-to-date information about resources available to students, as well as formal course policies, on our website at [www.sph.umn.edu/student-policies/](http://www.sph.umn.edu/student-policies/). Students are expected to read and understand all policy information available at this link and are encouraged to make use of the resources available.

The University of Minnesota has official policies, including but not limited to the following:

- Grade definitions
- Scholastic dishonesty
- Makeup work for legitimate absences
- Student conduct code
- Sexual harassment, sexual assault, stalking and relationship violence
- Equity, diversity, equal employment opportunity, and affirmative action
- Disability services
- Academic freedom and responsibility

Resources available for students include:

- Confidential mental health services
- Disability accommodations
- Housing and financial instability resources
- Technology help
- Academic support

### **EVALUATION & GRADING**

[Enter a detailed statement of the basis for grading here. Include a breakdown of course components and a point system for achieving a particular grade. Include expected turnaround time for grading/feedback. Please refer to the University's Uniform Grading Policy and Grading Rubric Resource at <https://z.umn.edu/gradingpolicy>]

#### **Grading Scale**

The University uses plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following, and you can expect the grade lines to be drawn as follows:

<b>% In Class</b>	<b>Grade</b>	<b>GPA</b>
93 - 100%	A	4.000
90 - 92%	A-	3.667
87 - 89%	B+	3.333
83 - 86%	B	3.000
80 - 82%	B-	2.667
77 - 79%	C+	2.333
73 - 76%	C	2.000
70 - 72%	C-	1.667
67 - 69%	D+	1.333
63 - 66%	D	1.000
< 62%	F	

- A = achievement that is outstanding relative to the level necessary to meet course requirements.
- B = achievement that is significantly above the level necessary to meet course requirements.
- C = achievement that meets the course requirements in every respect.
- D = achievement that is worthy of credit even though it fails to meet fully the course requirements.
- F = failure because work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I (Incomplete).
- S = achievement that is satisfactory, which is equivalent to a C- or better
- N = achievement that is not satisfactory and signifies that the work was either 1) completed but at a level that is not worthy of credit, or 2) not completed and there was no agreement between the instructor and student that the student would receive an I (Incomplete).

Evaluation/Grading Policy	Evaluation/Grading Policy Description
<p><b>Scholastic Dishonesty, Plagiarism, Cheating, etc.</b></p>	<p>You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis (As defined in the Student Conduct Code). For additional information, please see <a href="https://z.umn.edu/dishonesty">https://z.umn.edu/dishonesty</a></p> <p>The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: <a href="https://z.umn.edu/integrity">https://z.umn.edu/integrity</a>.</p> <p>If you have additional questions, please clarify with your instructor. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.</p> <p>Indiana University offers a clear description of plagiarism and an online quiz to check your understanding (<a href="http://z.umn.edu/iuplagiarism">http://z.umn.edu/iuplagiarism</a>).</p>
<p><b>Late Assignments</b></p>	<ul style="list-style-type: none"> <li>• No credit will be given for in-class activities that are not submitted during the class period.</li> <li>• Other assignments: 2 points will be deducted for each day that the assignment is submitted past the deadline. For example, if an assignment is due by 5:00 pm on a Friday, 2 points will be deducted if the assignment is turned in after 5:00 pm. Four points will be deducted if the assignment is turned in after 5:00 pm on Saturday, etc.</li> </ul>
<p><b>Attendance Requirements</b></p>	<p>Class attendance is very important because most classes will included in-class activities. Therefore, students are expected to attend all of the classes All students are required to attend all the class presentations on April 24 and May 1.</p>
<p><b>Extra Credit</b></p>	<p>There is no option for extra credit.</p>