Term Information

Effective Term	Autumn 2026
Previous Value	*Summer 2020*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

This course, which has not been offered since 2020, is being reimagined and updated to a Lived Environments GE theme course.

What is the rationale for the proposed change(s)?

This update will broaden the appeal and usefulness of this course for students.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

none

Is approval of the requrest contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Pharmacy
Fiscal Unit/Academic Org	Pharmacy - D1800
College/Academic Group	Pharmacy
Level/Career	Undergraduate
Course Number/Catalog	2934
Course Title	Potions and Poisons: The Dark Art of Toxicology
Previous Value	*It's Not Magic, It's Pharmaceutical Sciences*
Transcript Abbreviation	Potions & Poisons
Previous Value	*Not Magic PharmSci*
Course Description	This introductory toxicology course explores how everyday environments shape our exposure to chemicals, natural toxins, and emerging contaminants and how these interactions influence human and ecological health. Drawing on parallels from fantasy narratives, such as Harry Potter, we will develop an understanding of how science can protect communities from harmful exposures in lived environments.
Previous Value	*This course will serve as an introduction to pharmaceutical and associated healthcare sciences. Topics covered include the history of medicine, drug discovery and development, natural products, and pertinent public health crises. Topics will be presented through connections made to fantasy narratives, such as Harry Potter.*
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	Yes
Is any section of the course offered	Greater or equal to 50% at a distance Less than 50% at a distance
Previous Value	*No*
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture

Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus, Lima, Mansfield, Marion, Newark, Wooster
Previous Value	*Columbus*

Prerequisites and Exclusions

Prerequisites/Corequisites	
Exclusions	
Previous Value	Not open to students enrolled in the BSPS program.
Electronically Enforced	No
Previous Value	**Yes**

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	51.2010
Subsidy Level	Baccalaureate Course
Intended Rank	Freshman, Sophomore, Junior, Senior

Requirement/Elective Designation

Lived Environments

Previous Value

Survey Course

Course Details

Course goals or learning objectives/outcomes

- Demonstrate understanding of fundamental concepts including dose-response relationships, threshold effects, and the principle that "the dose makes the poison" through analysis of both fictional and real-world scenarios.
- Explain how toxic substances move through biological systems and identify mechanisms by which toxins cause cellular and organ damage.
- Assess how different exposure pathways (ingestion, inhalation, dermal, injection) influence toxicity and apply this knowledge to predict outcomes in various poisoning scenarios.
- Analyze the mechanisms by which antidotes work, from chelating agents to receptor antagonists, and evaluate the limitations and applications of poison control measures.
- Integrate concepts from chemistry, biology, pharmacology, and medicine to explain complex toxicological phenomena in both magical and scientific contexts.
- Distinguish between myth and scientific reality in historical and contemporary accounts of poisonings, and assess the credibility of toxicological claims using evidence-based reasoning.

Previous Value

- *Compare the role and evolution of medical treatments, providers and patients over time*
- *Identify basic principles of drug action and factors that impact a drug response when developing therapeutic strategies*
- *Explain how healthcare is influenced by traditional medicine, natural products and complementary medicine*
- *Evaluate contemporary therapies and medication-related issues*
- *Interpret medical information from individual and public health perspectives*

Content Topic List

- Principles of Toxicology
- Toxicokinetics
- Types of Toxicants (Common and Industrial)
- Types of Toxicants (Animal and Plant)
- Mechanisms of Toxicity
- Target Organ Toxicity (Liver and Kidney)
- Target Organ Toxicity (Neuro)
- Target Organ Toxicity (Respiratory)
- Non-Organ-Directed Toxicity
- Forensic Toxicology
- Environmental Toxicology
- Pharmaceutical Toxicology
- Antidotes and Treatment

Previous Value

- *History of medicine*
- *Drug Discovery and Development*
- *Science of Compounding*
- *Placebo Effect*
- *Complementary and Alternative Medicine*
- *Natural Products*
- *Interpretation of Medical Literature*
- *Health Misinformation*
- *Public Health Crisis*
- *Poisons, Vaccinations, Antidotes*

Sought Concurrence

No

Attachments

- PHR2934 Syllabus.pdf: syllabus

  (Syllabus. Owner: Bowman,Michael Robert)
- PHR 2934 Course Map.pdf: course map

  (Other Supporting Documentation. Owner: Bowman,Michael Robert)
- GE Goals related to Course project.pdf: GE goals assessment

  (GEC Course Assessment Plan. Owner: Bowman,Michael Robert)
- submission-lived-environments.pdf: GE theme worksheet

  (Other Supporting Documentation. Owner: Bowman,Michael Robert)

Comments

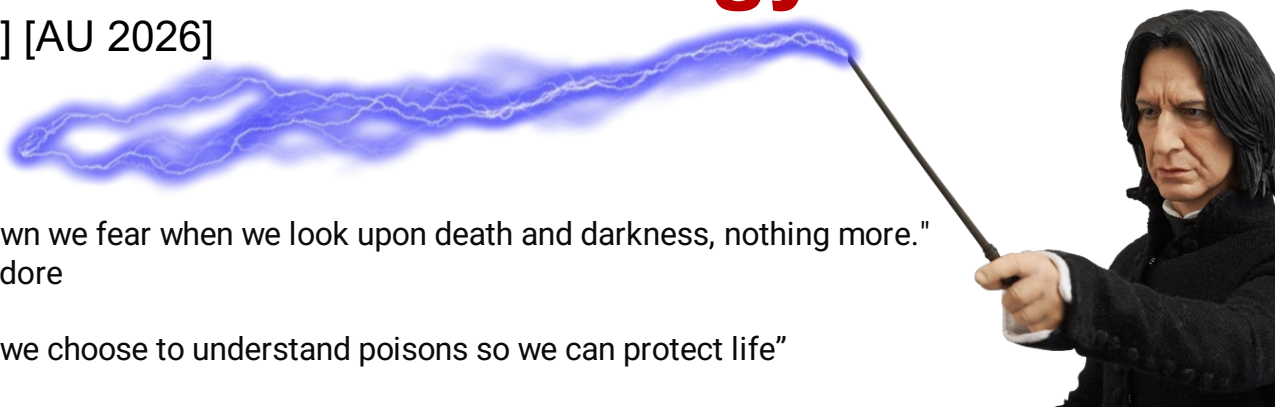
- approved by Undergraduate Studies Committee 12/16/25 *(by Bowman,Michael Robert on 01/14/2026 03:12 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Bowman,Michael Robert	01/14/2026 03:14 PM	Submitted for Approval
Approved	Fette,Nicole Elizabeth-Ann	01/15/2026 10:31 AM	Unit Approval
Approved	Kwiek,Nicole Cartwright	01/15/2026 10:34 AM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Neff,Jennifer Vankeerbergen,Bernadette Chantal Wade,Macy Joy Steele,Rachel Lea	01/15/2026 10:34 AM	ASCCAO Approval

Potions and Poisons: The Dark Art of Toxicology

[PHR 2934] [AU 2026]



"It is the unknown we fear when we look upon death and darkness, nothing more."
-Albus Dumbledore

“In toxicology, we choose to understand poisons so we can protect life”
-Anonymous

Course Information

- **Course times and location:** TBD
- **Credit hours:** [3]
- **Mode of delivery:** Hybrid

Instructor

- **Name:** Leslie C Newman, PhD
- **Email:** newman.439@osu.edu
- **Office location:** 253 Parks Hall
- **Office hours:** TBD
- **Preferred means of communication:**
    - My preferred method of communication for questions is **email.**
    - My class-wide communications will be sent through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to be sure you receive these messages.

Teaching Assistant

- **Name:** TBD
- **Email:** TBD

Course Prerequisites

None

Course Description

This introductory toxicology course explores how everyday environments shape our exposure to chemicals, natural toxins, and emerging contaminants and how these interactions influence human and ecological health. Drawing on parallels from fantasy narratives, such as Harry Potter, we will use case studies, hands-on activities, and reflective discussions, to develop a grounded understanding of how science can protect communities from harmful exposures in the lived environments we navigate each day.

Learning Outcomes

By the end of this course, students should successfully be able to:

- Demonstrate understanding of fundamental concepts including dose-response relationships, threshold effects, and the principle that "the dose makes the poison" through analysis of both fictional and real-world scenarios.
- Explain how toxic substances move through biological systems and identify mechanisms by which toxins cause cellular and organ damage
- Assess how different exposure pathways (ingestion, inhalation, dermal, injection) influence toxicity and apply this knowledge to predict outcomes in various poisoning scenarios.
- Analyze the mechanisms by which antidotes work, from chelating agents to receptor antagonists, and evaluate the limitations and applications of poison control measures.
- Integrate concepts from chemistry, biology, pharmacology, and medicine to explain complex toxicological phenomena in both magical and scientific contexts.
- Distinguish between myth and scientific reality in historical and contemporary accounts of poisonings, and assess the credibility of toxicological claims using evidence-based reasoning.

General Education Expected Learning Outcomes

As part of the Lived Environments Theme category of the General Education curriculum, this course is designed to prepare students to be able to do the following:

- 1.1 Engage in critical and logical thinking about the topic or idea of lived environments.
- 1.2 Conduct an advanced, in-depth, scholarly exploration of the topic or idea of lived environments.
- 2.1 Identify, describe, and synthesize approaches or experiences as they apply to lived environments.

- 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment and creative work, building on prior experiences to respond to new and challenging contexts.
- 3.1 Engage with the complexity and uncertainty of human-environment interactions.
- 3.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space.
- 4.1 Inspect how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors.
- 4.2 Detail how humans perceive and represent the environments with which they interact.
- 4.3 Analyze and critique conventions, theories and ideologies that influence discourses around environments.

This course fulfills these learning outcomes by examining how humans have historically and contemporarily interacted with toxic substances in their environments, from ancient civilizations using plant-based poisons to modern industrial chemical exposures and pharmaceutical interventions. Students will critically analyze the complex and often uncertain relationships between toxic agents and biological systems (3.1), exploring how environmental contamination, iatrogenic drug toxicity, and deliberate poisonings have transformed human health outcomes across time and geography (3.2). The course investigates the paradoxical nature of pharmaceuticals as both healing agents and potential toxins, examining how the same substance can cure or kill depending on dose, individual variability, and drug interactions, mirroring the duality of potions in the wizarding world. Through comparative analysis of magical and Muggle toxicology, students will engage in scholarly exploration of how cultural contexts shape our understanding of poisons and antidotes (1.1, 1.2), synthesizing approaches from chemistry, pharmacology, medicine, folklore, and public health to understand lived experiences with toxins (2.1). The course encourages metacognitive reflection as students apply toxicological principles to novel scenarios, developing their scientific reasoning skills while grappling with ethical dilemmas surrounding poison use, drug development, and the regulatory frameworks that govern pharmaceutical safety (2.2). By investigating how societies throughout history have perceived, feared, and weaponized toxic substances, from medieval beliefs about bezoars to contemporary debates about opioid crises and the balance between therapeutic benefit and adverse drug reactions, students will examine how human interactions with toxins and medicines have profoundly shaped cultural attitudes, legal frameworks, and scientific paradigms (4.1, 4.2, 4.3). This interdisciplinary approach reveals toxicology not merely as a biological science, but as a lens through which to understand humanity's evolving relationship with the chemical environment we inhabit, manipulate, and depend on for survival.

How This [Hybrid] Course Works

Mode of delivery: This course is hybrid. We have required sessions each week on TBD. The remainder of your work will take place in Carmen throughout the week.

Pace of online activities: This course is divided into **weekly modules** that are released one week ahead of time. Students are expected to keep pace with weekly deadlines but may schedule their efforts freely within that time frame.

Credit hours and work expectations: This is a [3] credit-hour course. According to Ohio State bylaws on instruction (go.osu.edu/credithours), students should expect around [3] hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to [6] hours of homework (reading and assignment preparation, for example) to receive a grade of [C] average.

Attendance and participation requirements: Research shows regular participation is one of the highest predictors of success. With that in mind, I have the following expectations for everyone's participation:

- **Participating in online activities for attendance**: **at least once per week**
  You are expected to log in to the course in Carmen every week. During most weeks you will probably log in many times. If you have a situation that might cause you to miss an entire week of class, discuss it with me *as soon as possible.*
- **Zoom meetings and office hours**: **optional**
  All live, scheduled events for the course, including my office hours, are optional. I will post recordings of synchronous sessions for those who cannot attend.
- **Participating in discussion forums**: **two or more times per week**
  As part of your participation, each week you can expect to post at least twice as part of our substantive class discussion on the week's topics.

Course Materials, Fees and Technologies

Required Materials and/or Technologies

- FREE e-book A Small Dose of Toxicology (available in multiple languages)
- Casarett and Doull's Essentials of Toxicology (freely available through OSU library)

Recommended/Optional Materials and/or Technologies

- Supplemental readings from open-access journals or websites like EPA toxicology resources

Fees and/or Additional Requirements

- None

Required Equipment

- **Computer:** current Mac (MacOS) or PC (Windows 10) with high-speed internet connection
- **Webcam:** built-in or external webcam, fully installed and tested
- **Microphone:** built-in laptop or tablet mic or external microphone
- **Other:** a mobile device (smartphone or tablet) to use for BuckeyePass authentication

If you do not have access to the technology you need to succeed in this class, review options for technology and internet access at go.osu.edu/student-tech-access.

Required Software

Microsoft Office 365: All Ohio State students are eligible for free Microsoft Office 365. Visit the installing Office 365 (go.osu.edu/office365help) help article for full instructions.

CarmenCanvas Access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions.
- Install the Duo Mobile application on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.
- Read about options to authenticate with BuckeyePass.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

Technology Skills Needed for This Course

- Basic computer and web-browsing skills
- Navigating CarmenCanvas (go.osu.edu/canvasstudent)

Technology Support

For help with your password, university email, CarmenCanvas, or any other technology issues, questions or requests, contact the IT Service Desk, which offers 24-hour support, seven days a week.

- **Self Service and Chat**: go.osu.edu/it
- **Phone:** 614-688-4357 (HELP)
- **Email:** servicedesk@osu.edu

Grading and Faculty Response

How Your Grade is Calculated

Assignment Category	Points
2 Exams	2 @ 50 points
Pre-class assignments (best 12 of 14)	12 @ 15 points
In-class activities (best 12 of 14)	12 @ 15 points
Quizzes (best 5 of 7)	5 @ 10 points
Mini assignments (5)	5 @ 10 points
Exit tickets (best 12 of 14)	12 @ 5 points
Course Project	75 points
Total points	695 points

See Course Schedule for due dates.

Descriptions of Major Course Assignments

Pre-class assignments

Description: Goal is to activate prior knowledge, utilize knowledge learned in recordings and readings, and set the stage for active learning sessions.

In-class activities

Description: These activities will involve active discussions, working through problems, peer collaborations, answering questions in real time, and applying new knowledge.

Mini assignments

Description: These assignments serve as frequent, low-stakes checkpoints that keep students engaged and progressing throughout the semester while providing the instructor with ongoing insights into student learning. These brief assessments vary in format and delivery method, creating a dynamic learning experience that accommodates different learning styles and prevents monotony.

In-class mini assignments might include quick problem sets completed individually or in small groups, one-minute papers where students summarize key concepts at the end of a session, think-pair-share exercises that promote peer discussion, or short quizzes using TopHat. These immediate activities reinforce learning while it's fresh and gives real-time feedback on whether students are grasping the material.

Remote mini assignments offer flexibility and extend learning beyond the classroom. These might include short reflection posts on discussion boards, brief video responses where students explain a concept in their own words, online quiz modules with instant feedback, collaborative annotations of course readings, or micro-projects like creating a single slide or diagram to illustrate an idea. Digital formats can incorporate multimedia elements and allow students to work at their own pace while still maintaining regular touchpoints with course material.

The variation in format, moving between written responses, visual representations, collaborative work, individual reflection, and hands-on application, ensures that students develop multiple ways of engaging with content.

Exit Tickets

Description: Exit tickets are brief, end-of-class assessments that serve as a powerful tool for gauging student understanding and closing the learning loop. Typically completed in the final few minutes of class, these quick prompts ask students to respond to a question, solve a problem, or reflect on what they've learned before leaving. The format is intentionally simple and low-pressure. These encourage metacognition by prompting students to actively process and consolidate what they've learned before leaving the classroom.

Course Project

Description: The course project encourages application of toxicology to real-world challenges, fostering a deeper understanding of how toxins shape our lived environments and will incorporate elements of the GE expected learning outcomes. Students will create a multimodal presentation that investigates a specific toxicological issue within a lived environment of their choice. This project will build on foundational concepts covered earlier in the course by requiring students to apply toxicological principles to real-world contexts at an advanced level. Students will select an environment (e.g., urban built spaces, agricultural fields, natural ecosystems, pharmaceutical industry, or cultural settings) and analyze how toxins interact with human life, drawing on interdisciplinary insights, personal experiences, and/or diverse perspectives. This

project also emphasizes creative and diverse ways to communicate complex ideas, incorporating visual, audio, digital, or performative elements.

Academic integrity and collaboration: [Example: Your written assignments, including discussion posts, should be your own original work. In formal assignments, you should follow [MLA/APA/Chicago etc.] style to cite the ideas and words of your research sources. You are encouraged to ask a trusted person to proofread your assignments before you turn them in but no one else should revise or rewrite your work.]

- **Quizzes and exams**: You must complete the midterm exams yourself, without any external help or communication. Weekly quizzes must be completed on your own unless otherwise indicated by the instructor.
- **Written assignments**: Your written assignments, including discussion posts, should be your own original work. In formal assignments, you can follow any format style to cite the ideas and words of your research sources. You are encouraged to ask a trusted person to proofread your assignments before you turn them in, but no one else should revise or rewrite your work.
- **Reusing past work**: In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with Dr. Newman.
- **Falsifying research or results**: All research you will conduct in this course is intended to be a learning experience; you should never feel tempted to make your results or your library research look more successful than it was**.**
- **Collaboration and informal peer-review**: The course includes many opportunities for formal collaboration with your classmates. While study groups and peer-review of major written projects is encouraged, remember that comparing answers on a quiz or assignment is not permitted. If you're unsure about a particular situation, please ask ahead of time.

Late Assignments

Please refer to Carmen for due dates. Due dates are set to help you stay on pace and to allow timely feedback that will help you complete subsequent assignments.

Instructor Feedback and Response Time

I am providing the following list to give you an idea of my intended availability throughout the course. Remember that you can call 614-688-4357 (HELP) at any time if you have a technical

problem.

- **Preferred contact method:** If you have a question, please contact me first through my Ohio State email address. I will reply to emails within **24 hours on days when class is in session at the university**.
- **Class announcements:** I will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Discussion board:** I will check and reply to messages in the discussion boards once mid-week and once at the end of the week.
- **Grading and feedback:** For assignments submitted before the due date, I will try to provide feedback and grades within **seven days**. Assignments submitted after the due date may have reduced feedback, and grades may take longer to be posted.]

Undergraduate and Graduate Grading Scale

A	A-	B+	B	B-	C+	C	C-	D+	D	E
100 - 93%	92.9 - 90%	89.9-87%	86.9-83%	82.9-80%	79.9-77%	76.9-73%	72.9-70%	69.9-67%	66.9-60%	59.9-0%

Other Course Policies

Discussion and Communication Guidelines

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online. I will provide specific guidance for discussions on controversial or personal topics.
- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.
- **Backing up your work**: Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

This includes but is not limited to: attending classes and workshops, arriving on time and staying for the entirety of class and workshop sessions, being actively engaging in the teaching/learning process, being prepared to participate in class discussions and activities (this includes doing the pre-class work), abiding by the Honor System, integrating self-study and collaboration with classmates into your work habits, providing feedback in a constructive and professional manner, respecting the rights, feelings and confidentiality of all students, faculty and patients participating in the course, and refraining from disruptive behaviors during all class sessions. While differing points of view are encouraged and expected in this course, it is also expected that these points of view will be expressed in a respectful and professional manner. Confrontational or discriminatory behavior will not be tolerated.

The use of electronic devices such as laptops and tablets may be beneficial for use during class, provided its use is focused on classroom content. Checking email/Facebook, shopping and/or texting etc. during class and workshops is not permitted and may result in a decrease in your course grade. Please note that all cell phones and pagers are to be turned to the vibrate mode or off during class and workshop. If a situation arises that you need to communicate via cell phone during class or workshop, please make prior arrangements with instructors.

Academic Integrity Policy

See Descriptions of Major Course Assignments for specific guidelines about collaboration and academic integrity in the context of this online class.

Ohio State's Academic Integrity Policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's Code of Student Conduct (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Artificial Intelligence and Academic Integrity

There has been a significant increase in the popularity and availability of a variety of generative artificial intelligence (AI) tools, including ChatGPT, Sudowrite and others. These tools will help shape the future of work, research and technology but when used in the wrong way, they can stand in conflict with academic integrity at Ohio State.

All students have important obligations under the Code of Student Conduct to complete all academic and scholarly activities with fairness and honesty. Our professional students also have the responsibility to uphold the professional and ethical standards found in their respective academic honor codes. Specifically, students are not to use unauthorized assistance in the laboratory, on field work, in scholarship or on a course assignment unless such assistance has been authorized specifically by the course instructor. In addition, students are not to submit their work without acknowledging any word-for-word use and/or paraphrasing of writing, ideas or other work that is not your own. These requirements apply to all students undergraduate, graduate, and professional.

To maintain a culture of integrity and respect, these generative AI tools should not be used in the completion of course assignments unless an instructor for a given course specifically authorizes

their use. Some instructors may approve of using generative AI tools in the academic setting for specific goals. However, these tools should be used only with the explicit and clear permission of each individual instructor, and then only in the ways allowed by the instructor.

Artificial Intelligence Policy for this Course

Acceptable and Unacceptable Uses of AI in this course

Students are expected to generate their own work. Submitting content that has been generated by someone other than yourself or that was created or written by a computer application or tool, including artificial intelligence (AI) programs such as ChatGPT, Copilot, etc. outside of the acceptable uses outlined below constitutes a violation of the Ohio State University Code of Student Conduct. Specific examples of acceptable and unacceptable uses of AI tools in this course are highlighted below.

The use of generative AI tools is permitted in this course for the following activities:
• Brainstorming and refining your ideas
• Organizing your thoughts and ideas into a paper structure such as in generating an outline
• Checking grammar and style
• When allowed in assignments as specifically stated by the instructor

The use of generative AI tools is NOT permitted in this course for the following activities:
• Impersonating you in classroom contexts, including using these tools to compose discussion board responses, answer quiz questions, or complete other assignments.
• Writing entire papers to complete class assignments
• Other uses that are determined to represent abuse of course policy

Additionally, you are responsible for the content of all work that you submit. AI tools tend to fabricate information to meet user-supplied prompts, including (but not limited to) misrepresenting findings and creating imaginary sources. Any work turned in with false information will receive a grade deduction and may be subject to penalty under Ohio State's Code of Student Conduct. Please contact Dr. Newman if you have any questions about a specific use of AI for a course assignment.

Copyright for Instructional Materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Creating an Environment Free from Harassment, Discrimination, and Sexual Misconduct

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Civil Rights Compliance Office:

1. Online reporting form at civilrights.osu.edu,
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or email civilrights@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

Intellectual Diversity

Ohio State is committed to fostering a culture of open inquiry and intellectual diversity within the classroom. This course will cover a range of information and may include discussions or debates about controversial issues, beliefs, or policies. Any such discussions and debates are intended to support understanding of the approved curriculum and relevant course objectives rather than promote any specific point of view. Students will be assessed on principles applicable to the field of study and the content covered in the course. Preparing students for citizenship includes

helping them develop critical thinking skills that will allow them to reach their own conclusions regarding complex or controversial matters.

Religious Accommodations

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement **and** the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Civil Rights Compliance Office.

Policy: Religious Holidays, Holy Days and Observances.

Counseling and Consultation Service and Mental Health Statement

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may

lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing.

If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting **ccs.osu.edu** or calling 614-292-5766. CCS is located on the 4th floor of the Younkin Success Center and 10th floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614-292-5766 and 24-hour emergency help is also available through the 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

College of Pharmacy specific resources

Any College of Pharmacy student may contact Dr. Levstek directly via email (levstek.4@osu.edu), and he will offer you an initial counseling session via Zoom to initiate services. During this meeting he will address your current concerns and mental health needs, in addition to collecting background information and assessing your history of concerns. He will also discuss future treatment options with you, and can connect you with other resources as well, where appropriate. If any students have questions or concerns, please email Dr. Levstek directly.

Disability Statement (with Accommodations for Illness)

Requesting Accommodations

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Accessibility of Course Technology

This course requires use of CarmenCanvas (Ohio State's learning management system). If you need additional services to use these technologies, please request accommodations as early as possible.

- CarmenCanvas accessibility (go.osu.edu/canvas-accessibility)

Grievances and solving problems

A student who encounters a problem related to his/her educational program has a variety of avenues available to seek resolution. (Note: the procedures for grade grievances are explicitly covered in the faculty rules) Typically, a student is advised to resolve any dispute, disagreement, or grievance as directly as possible, engaging with the person or persons most closely involved. The faculty and staff of the departments and colleges are available to work with students in this regard. If this step does not produce acceptable results, the student should follow a logical stepwise progression to address the academic concerns.

According to University Policies, if you have a problem with this class, you should seek to resolve the grievance concerning a grade or academic practice by speaking first with the instructor or professor. Then, if necessary, take your case to the department chairperson, college dean or associate dean, and to the provost, in that order. Specific procedures are outlined in Faculty Rule 3335-8-23. Grievances against graduate, research, and teaching assistants should be submitted first to the supervising instructor, then to the chairperson of the assistant's departmen

Course Schedule

Refer to the CarmenCanvas course for up-to-date due dates.

Week	Individual Learning and Prep	In-class Learning/Activities	Topics		Assignments & Due Dates
			The Magic	The Science	
1 Intro to Toxicology - "**Welcome to potions class"**	Read: A Small Dose of Toxicology (CH1 pgs 1-9; CH2 pgs 10-13; CH5 pgs 1-5) Watch: Intro to PHR2934/Intro to toxicology	Historical case studies – Minamata disease, Lead in Roman times, Borgia poison; Potion label analysis	"Draught of Living Death", "Felix Felicis"	Paracelsus' principle; Hazard vs risk; Acute vs chronic; Routes of exposure; Therapeutic index; LD_{50}	Pre-class work Quiz Activity Exit Ticket
2 Toxicokinetics - **"What happens when you drink a potion?"**	Read: A Small Dose of Toxicology (CH2 pgs 13-18) Watch:Toxicokinetics video	Acetaminophen toxicity; Polyjuice potion time-concentration graph activity	"Polyjuice Potion"; "Felix Felicis"; "Veritaserum"; Ingestion (potions), Inhalation (brewing fumes), Injection (Basilisk fangs, spider venom), Dermal (Bubotuber pus)	ADME; half-life; clearance; 1st pass metabolism; bioavailability	Pre-class work Quiz Activity Exit Ticket Assignment #1 - Toxicokinetic Detective
3 Principles of Toxicology - "**Getting the potion just right"**	Read: A Small Dose of Toxicology (CH2 pgs 2-10) Watch: Principles of Toxicology	Magical case study – The Tragedy of the Crouch House Elf (Butterbeer bottles); Dose response potions exercise	"Sleeping Draught"; "Calming Draught"; "Basilisk venom"; "Wit-Sharpening Potion"; Wideye potion (antag) Ministry of Magic regulation	Dose-response fundamentals; threshold vs non-threshold toxicants; graded vs quantal responses; warfarin; digoxin	Pre-class work Quiz Activity Exit Ticket Assignment #2 – The Complexity of Chemical Safety and Risk Assessment

4 Types of Toxicants (Common and Industrial) - **"Floo Powder to Formaldehyde"**	Read: A Small Dose of Toxicology (CH11-CH17 various pgs) Watch: Types of toxicants	Toxicant analysis; personal assessment of exposure to common toxicants	Poisoned mead	Metals; Pesticides; Organic solvents (benzene); plastics (BPA, phthalates); food contaminants (preservatives, mycotoxins)	Pre-class work Quiz Activity Exit Ticket
5 Types of Toxicants (Animal and Plant) - **"Venoms, Bites and Mandrakes"**	Read: A Small Dose of Toxicology (CH22 pgs 2-16) Watch: Poisonous plants, venomous animals & toxic organisms: A deadly compilation	Case studies	Mandrake	Venoms, marine toxins, alkaloids, glycosides, terpenes & essential oils	Pre-class work Quiz Activity Exit Ticket
6 Mechanisms of Toxicity – "**How poisons work"**	Read: Mechanisms of toxicity Watch: Mechanisms of toxicity	Magical case study – The Poisoning of Ron Weasley	"Phoenix Tears"; "Veritaserum"; "Dementor's Kiss"; "Bezoar"	Mechanisms of cellular toxicity; oxidative stress & free radical damage; receptor-mediated toxicity	Pre-class work Quiz Activity Exit Ticket Assignment #3 - Making the Invisible Visible
7 **Review and Midterm (O.W.L.) Exam**					**Exam #1**
8 Target Organ Toxicity (Liver and Kidney) - **"The liver as a cauldron/ Kidneys and filtration charms"**	Read: Impact of alcohol use on liver disease outcomes; Nonsteroidal anti-inflammatory drugs and organ damage: A current perspective Watch: How your liver works; Liver failure; How your kidneys	Magical case study - Potion master's toxicity challenge	Polyjuice potion; Felix Felicis; Wolfsbane potion; Veritaserum	Hepatotoxicity (e.g. alcohol/drugs); Nephrotoxicity (e.g. heavy metals); biomarkers of damage	Pre-class work Quiz Activity Exit Ticket

	work; Target organ toxicity				
9 Target Organ Toxicity (Neuro) - **"Curses and the Nervous System"**	Read: Introduction to Neurotoxicity: An overview Watch: Neurotoxins; Intro to nervous system and target organ toxicity	The poisoned goblet of fire mystery	"Cruciatus Curse"; "Imperius Curse"	Organophosphates and other Pesticides; Heavy metals; CNS depressants and mind control; Pain pathways and neurotransmitters	Pre-class work Quiz Activity Exit Ticket
10 Target Organ Toxicity (Respiratory) - **"Dementors of Dust"**	Read: Toxic effects on respiratory system Watch: Toxicology of Tobacco smoke; intro to respiratory system and respiratory toxicology	Case scenarios	Draught of Living Death, Sopophorous bean	Air pollutants; Asbestos; Bhopoal disaster; Occupational and Regulatory Toxicology	Pre-class work Quiz Activity Exit Ticket
11 Non-Organ-Directed Toxicity - **"Dark Magic and Cancer"**	Read: Casarett & Doull's Essentials of Toxicology, various pgs; Reproductive toxicology: keeping up with our changing world Watch: Non-organ directed toxicology	Sorting hat scenario, potion mishaps case studies	"Horcruxes", "The Deathly Hallows Resurrection Stone"; Basilisk venom	Genetic and epigenetic effects of toxins; Carcinogenesis; Mutagenesis	Pre-class work Quiz Activity Exit Ticket
12 Forensic Toxicology: Love Potions, Truth Serums – **"Interrogation Agents of the Wizarding World"**	Read: The making of "truth serum", What is truth serum, Narcoanalysis: the science behind truth serums Watch: The truth about truth serums, Psychoactive substances, Love potions and truth serums	Roleplay scientist – development of empathy pill	"Veritaserum"; "Amortentia"	Sodium Pentothal; Psychoactive substances	Pre-class work Quiz Activity Exit Ticket

13 Environmental & Toxicology - **"Death Eaters & Death Molecules"**	Read: Introduction to environmental toxicology Watch: Alligators can teach us about advers effects of chemical pollution	The mystery illness	Emerald poison	Pollutants (acid rain, PFAS); ecotoxicology; biomagnification in food chains; Flint water crisis	Pre-class work Quiz Activity Exit Ticket Assignment #4 - Tracking Toxicants: A Multi-Scale Investigation Activity
14 Pharmaceutical Toxicology – **"Muggle Elixirs and their Lethal Limits"**	Read: A Small Dose of Toxicology (CH7-CH10 various pgs) Watch: Pharmaceutical toxicology	Polyjuice potion gone wrong	"Skele-Gro"; "Gillyweed"; "Draught of Peace"	Drug toxicity & adverse effects; Pharmacoethics; Safety testing; Investigative toxicology	Pre-class work Quiz Activity Exit Ticket
15 Antidotes and Treatment - **"Defense against the Dark Arts"**	Read: Antidotes in clinical toxicology-critical review, Antidotes in the management of poisoned patients: What have we gained over the last decade? Watch: Antidotes and treatment of toxicity	Antidote challenge (Healer teams)	"Bezoar"; "Anti-Love Potion Elixir"; "Phoenix Tears"; "Supportive care for Dumbledore"	Principles of antidote therapy; chelation therapy; overdose epidemics	Pre-class work Quiz Activity Exit Ticket Assignment #5 - Role Playing and Reflection
Finals	N.E.W.T.S.				**Exam #2**

Course Roadmap
Potions and Poisons: The Dark Art of Toxicology
PHR 2934

Week 1: Introduction to Toxicology – "Welcome to Potions Class"

Objectives

- Become familiar with course policies and processes
- Define toxicology and explain Paracelsus's principle "the dose makes the poison"
- Identify the difference between hazard and risk
- Describe basic routes of exposure (ingestion, inhalation, dermal, injection)
- Explain LD_{50} and therapeutic index

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

Goal: Designed to activate prior knowledge and set the stage for lecture

Read

- Gilbert, S.G. (2020). *A Small Dose of Toxicology: The Health Effects of Common Chemicals (3rd ed.). CRC Press. Chapter 1. pgs.* 1-9. Chapter 2. pgs 10-13. Chapter 5. pgs 1-5.
  - This source provides a review of the basics of toxicology and serves as a resource to complement lectures and activities.
- Nogué, S., Morueta-Holme, N., Fernández-Palacios, J.M. et al. *Human transformation of past terrestrial ecosystems*. Nat. Rev. Biodivers. 1, 644–656 (2025)
  - Examines how humans have been modifying ecosystems for millennia
- Stahlmann R, Horvath A. *Risks, risk assessment and risk competence in toxicology*. Ger Med Sci. 2015 Jul 9;13
  - Discusses how laypeople hardly differentiate between levels of toxicity and often disregard dose-effect relationships, believing that mere contact with a toxic substance is a health risk, and how most laypeople consider natural substances less dangerous than synthetic compounds

Watch

1. Introduction to PHR 2934 (~20 min)

Do

- **Discussion Post #1 – Optional Meet & Greet**

- Objective
  - Develop membership in a course community
- Directions

Think

- What makes a substance poisonous?

IN-CLASS LEARNING/ACTIVITIES

Watch clip: Snape's first potions class speech (Sorcerer's Stone)

Discuss

- Foundational concepts
  - What makes a substance poisonous?
  - The dose-response relationship and Paracelsus's principle that "the dose makes the poison" - why is this concept central to understanding toxicology?
    - Magical world
      - Fictional “Sleeping Draught” to illustrate dose-response curves
      - “Felix Felicis” beneficial in small doses but causes recklessness and arrogance in excess; “Draught of Living Death” 3 drops puts you to sleep, 4 drops might be fatal
    - Real world
      - % difficulty walking vs glasses of alcohol
      - Caffeine – coffee is fine but pure caffeine powder can be lethal; Barbiturates sedation vs coma vs death
      - Black licorice (glycyrrhizic acid) has killed healthy adults who binged a bag in one sitting (2020 Massachusetts case)
- The difference between hazard and risk: how do we evaluate whether something is dangerous versus the likelihood of harm occurring?
- Historical perspectives
  - Historical poisoners (Borgias) vs fictional (Voldemort)
  - Famous poisoning cases throughout history and what we learned (lead poisoning in Rome, arsenic as a historical poison, Minamata disease)
  - The evolution of drug safety regulations following disasters like thalidomide
- Modern Applications
  - The role of toxicologists in pharmaceutical development - balancing efficacy with safety
  - Environmental toxicology: how do we assess the impact of pollutants on ecosystems and human health?
  - Forensic toxicology and its role in legal and medical investigations

 **Activity**

- Historical case studies
  - Minamata disease, Lead in Roman times
- Potion Label Analysis: Students work in pairs to analyze fictional potion labels
  - Each label lists ingredients, dosage, warnings
  - Students identify: route of exposure, potential toxic effects, safety concerns, potential relation to real world substances

 **Quiz**

- Quizzes are meant to encourage focus on foundational material and to give students practice in answering questions about the material.
- **Quiz #1**
  - This quiz will be based on course policies to ensure students understand how the course works and how to do well

 **Exit Ticket –** Is it toxic? (water, chocolate, oxygen, hemlock)

Week 2: Toxicokinetics – "What happens when you drink a potion?"

 **Objectives**

- Explain the four phases of toxicokinetics (ADME)
  - Analyze how lipid solubility, molecular size, and ionization state affect toxicant absorption and distribution
- Compare and contrast the toxicokinetics of different routes of exposure for the same substance
- Evaluate why certain toxicants preferentially accumulate in specific tissues (fat, bone, liver)
- Predict how changes in hepatic or renal function will affect toxicant kinetics
- Understand first-pass metabolism
- Explain half-life and clearance
  - Use half-life data to predict toxicant accumulation with repeated exposures
- Explain the the rationale behind therapeutic drug monitoring using toxicokinetic principles
- Predict which elimination enhancement techniques (dialysis, urinary alkalinization, chelation) would be most effective based on a toxicant's kinetic properties

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

 **Read**

- Gilbert, S.G. (2020). *A Small Dose of Toxicology: The Health Effects of Common Chemicals (3rd ed.). CRC Press. Chapter 2. Pgs 13-18*

Watch

- Toxicokinetics (ADME) video (~20 min)

Do

- Draw or label the path you think a swallowed chemical takes through the body
- Mark where you think the chemical might be absorbed, stored, changed, or eliminated
- Add arrows showing movement and any organs you think might be involved

Think

- How do potions know where to go and what to do; Why do you think some medications are taken multiple times per day while others are once daily or even weekly?

IN-CLASS LEARNING/ACTIVITIES

Watch clip: Polyjuice Potion transformation scene (Chamber of Secrets)

Discuss

- How do the four phases (Absorption, Distribution, Metabolism, Excretion) work together to determine a toxicant's duration and intensity of action?
- Why is understanding ADME is critical for predicting toxic effects and designing antidotes?
- Why does it matter whether a toxicant is absorbed through the GI tract versus other routes?
- How does metabolism detoxify some substances but increase toxicity of others?
- How do clearance and half-life predict accumulation with repeated exposures?
    - Magic example: "How long does Polyjuice Potion stay in your system? (Exactly 1 hour - very convenient!)"

- **Practical Applications**
    - How can we use toxicokinetic principles in poison treatment (enhancing elimination, blocking absorption)
    - How does therapeutic drug monitoring relate to toxicokinetic principles
    - Biomonitoring: interpreting blood, urine, or tissue levels of toxicants

Activity

- Students work in groups to create a time-concentration graph for Polyjuice Potion
- Given information:
    - Takes 15 minutes to reach peak effect after drinking
    - Effect lasts exactly 1 hour

- Metabolism occurs in liver
- Excretion via kidneys
- Groups plot concentration vs. time and present their reasoning

- Students map the ADME pathway for a common toxicant (e.g., mercury from fish), using handouts or diagrams

Quiz #2

Exit Ticket – Explain in 2-3 sentences why you can't just drink more Polyjuice Potion to make the effect last longer

Assignment #1: The Toxicokinetic Detective Challenge (25 points)

- **Objective:** Apply critical and logical thinking to analyze how a chemical moves through the body using toxicokinetic principles.

Week 3: Principles of Toxicology – "Getting the potion just right"

Objectives

- Define the dose-response relationship and explain its fundamental importance in toxicology
- Distinguish between graded (individual) and quantal (population) dose-response relationships
- Define key dose-response parameters: LD50, ED50, TD50, NOAEL, LOAEL, and therapeutic index
- Interpret dose-response curves to compare the relative toxicity and potency of different substances
- Calculate therapeutic index and margin of safety from given dose-response data
- Analyze how factors such as route of exposure, duration, and individual variability affect dose-response relationships
- Use dose-response data to predict the percentage of a population affected at a given dose
- Evaluate the limitations and uncertainties in extrapolating from high-dose animal studies to low-dose human exposures
- Apply dose-response principles to explain why some individuals experience adverse effects while others do not at the same exposure level
- Use therapeutic index concepts to explain the safety margin of common medications
- Interpret real-world scenarios (pesticide exposure limits, drug overdoses, occupational standards) through the lens of dose-response relationships

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

Read

Gilbert, S.G. (2020). *A Small Dose of Toxicology: The Health Effects of Common Chemicals (3rd ed.). CRC Press. Chapter 2. pgs .2-10.*

Watch

- Principles of Toxicology (~20 min)

Do

- Case study: "The Tragedy of the Crouch House Elf"
  - Winky found with empty Butterbeer bottles
  - House elves are much smaller than humans
  - Why did the same amount affect her so differently?

Think

- How do we measure toxicity scientifically?

IN-CLASS LEARNING/ACTIVITIES

Watch clip: Felix Felicis (liquid luck potion) - (Half-Blood Prince)

Discuss

- Interpret dose-response curves
  - The difference between potency and efficacy: how can two substances have different dose-response curves but similar maximum effects, or vice versa?
  - Threshold versus non-threshold dose-response models: when does each apply, and why does this distinction matter for regulatory standards?
    - Some substances may have no "safe" dose (non-threshold)
      - Is there a safe dose of Basilisk venom? Probably not!
  - Graded (individual) versus quantal (population) dose-response curves: what questions does each type answer?
  - Hormesis and U-shaped dose-response curves: can low doses of toxicants actually be beneficial?
- Therapeutic index and margin of safety: how do we quantify the difference between beneficial and harmful doses?
  - Example: Essential nutrients that become toxic at high doses (vitamin A, selenium, iron): how do we define the safe range?
- How can we use dose-response relationships to guide clinical treatment of poisonings?

Activity

- Students receive data sets for three fictional potions:
  - Calming Draught
  - Wit-Sharpening Potion
  - Draught of Living Death
- For each potion, students get data on:

    - 100 test subjects (wizarding rats)
    - Various doses administered
    - Responses measured (desired effect and toxic effects)
- Tasks:
    - Create dose-response curves for both desired and toxic effects
    - Calculate ED50 and TD50
    - Calculate therapeutic index
    - Rank potions from safest to most dangerous
    - Make recommendations for safe dosing in humans
- Discussion Questions:
    - Why might the Ministry of Magic restrict certain potions?
    - How would you design a safer version of Draught of Living Death?
    - What additional safety measures should be in place for potions with low TI?
    - Discuss real-world connection: Many real drugs have narrow therapeutic indices (warfarin, digoxin, chemotherapy)

 **Quiz #3**

Exit Ticket – Is there a safe dose for any toxicant? Use examples like caffeine or alcohol.

 **Assignment #2 - The Complexity of Chemical Safety and Risk Assessment**

Objective: explores why chemical safety isn't one-size-fits-all and why scientific studies sometimes seem to contradict each other. Students will investigate how the same substance can be safe for some people but harmful to others and why translating laboratory findings to real-world human health is so challenging.

Week 4 Types of Toxicants (Common and Industrial) - – "Floo Powder to Formaldehyde"

 **Objectives**

- Identify at least five major categories of industrial toxicants (e.g., heavy metals, organic solvents, pesticides, gases, particulates)
- Describe the primary routes of exposure for common workplace and environmental toxins
- Analyze case studies to identify potential toxic exposures in occupational or environmental settings
- Assess the relative hazards of different industrial toxins based on dose-response relationships, exposure potential, and toxicity profiles

- Integrate knowledge of toxicokinetics and toxicodynamics to predict potential health outcomes from various exposure scenarios

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

 **Read**

Gilbert, S.G. (2020). *A Small Dose of Toxicology: The Health Effects of Common Chemicals (3rd ed.). CRC Press. Chapters 11-17.*

 **Watch**

- Types of Toxicants (~20 min)

 **Do**

- Think about your activities from the moment you woke up today until you arrived at class. Create a timeline and list:
  - Products you used (cleaning supplies, personal care items, food containers, electronics)
  - Environments you were in (your home, car, public transit, campus buildings)
  - Activities you engaged in (cooking, commuting, using technology)
  - Next to each item, write down any chemicals or potential toxicants you think might be present, even if you're just guessing. For ex: "Morning coffee - caffeine, pesticide residues?" or "Shower - chlorine in water, fragrance chemicals in shampoo?"
  - Which potential exposures surprised you?
  - Where do you have the most uncertainty about what you're exposed to?

 **Think**

- What makes something a "toxin" versus just a "chemical"?

IN-CLASS LEARNING/ACTIVITIES

 **Watch** clip: The poisoned mead scene (Half-Blood Prince)

 **Discuss**

- Can the same substance be both safe and dangerous? (ex. Warfarin)
- How does the chemical form of a substance determine toxicity and exposure routes?
- Why does studying individual chemicals may not predict real-world toxicity from complex mixtures?
- What are unique toxicological properties of nanoparticles compared to bulk materials

- The bezoar acts as a universal antidote in the wizarding world, do such things exist in real toxicology?

Activity

- Create two columns: Common Toxicants and Industrial Toxicants.
  - Brainstorm examples you already know (e.g., lead paint, carbon monoxide, asbestos, pesticides).
  - Briefly discuss differences in exposure settings (home vs. workplace/industry)
- Consider scenarios
  - A child playing with old painted toys (lead)
  - A factory worker exposed to benzene in solvents
  - A family using pesticides in their garden
  - A welder inhaling fumes containing cadmium
  - A person using cleaning products with ammonia
- Instructions
  - Identify the toxicant.
  - Classify it as common or industrial
  - Discuss possible health effects and routes of exposure (inhalation, ingestion, dermal)
  - Suggest one prevention or safety measure

Quiz #4

Exit Ticket – What is a new fact about toxicants you learned today that surprised you?

Week 5 Types of Toxicants (Animal and Plant) - "Venoms, Bites and Mandrakes"

Objectives

- Define key terminology including toxin, toxicant, venom, poison, zootoxin, phytotoxin, and envenomation
- Define the difference between venomous and poisonous organisms
- List major categories of animal toxicants (e.g., venoms, biotoxins from marine organisms, insect toxins) and plant toxicants (e.g., alkaloids, glycosides, lectins, oxalates)
- Describe the basic mechanisms by which animal venoms cause toxicity (neurotoxic, hemotoxic, cytotoxic)
- Compare and contrast the delivery mechanisms of animal toxins (active envenomation vs. passive poisoning)
- Recognize common toxic plants found in domestic and wild environments that pose human health risks, describe mechanisms of toxicity, and compare delivery mechanism
- Identify historical use of plant and animal toxins as poisons (aconite, ricin, curare)

- Analyze case studies to identify the likely plant or animal toxicant based on clinical presentation and exposure history
- Explain how natural toxins have contributed to pharmaceutical drug development
    - Evaluate the potential therapeutic applications of compounds derived from venoms and toxic plants
    - Identify at least three medically significant venomous animals from different taxonomic groups (e.g., snakes, spiders, marine organisms)

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

 **Read**

- Gilbert, S.G. (2020). *A Small Dose of Toxicology: The Health Effects of Common Chemicals (3rd ed.). CRC Press. Chapter 22*. pgs 2-16.

 **Watch**

- Poisonous Plants, Venomous Animals & Toxic Organisms | A Deadly Compilation (~24 min)

 **Do**

- **TRUE/FALSE Exercise**
    - "Brightly colored animals are always poisonous"
    - "You can safely eat any plant that birds or deer eat"
    - "All parts of a toxic plant are equally dangerous"
    - "If you're bitten by a venomous snake, you should suck out the venom"
    - "Cooking destroys all plant toxins"
    - "Touching a toad will give you warts"

 **Think**

- Why do you think plants and animals produce toxins? What purpose does it serve for them?

IN-CLASS LEARNING/ACTIVITIES

 **Watch** clip: Professor Sprout's Herbology class on Mandrakes (Chamber of Secrets)

 **Discuss**

- Why do organisms produce toxins?
- The arms race between toxic organisms and their predators: how do some animals develop resistance or tolerance?
- Why do some toxins bioaccumulate while others are efficiently eliminated?
- Energy cost of toxin production: why don't all organisms produce toxins for defense?
- The therapeutic index of natural compounds: when does a toxin become a medicine?
    - Bioprospecting: discovering new pharmaceuticals from venoms and plant toxins
        - Conotoxins, cone snail peptides, and drug development

- Using venom components for targeted therapeutics (e.g., captopril from snake venom)

 **Activity**

Toxin Detectives

Choose a case to investigate

- Case 1: The Backyard BBQ
  - A 4-year-old girl at a family cookout picks pretty purple flowers and puts them in her mouth. Within 30 minutes, she's vomiting and complaining her heart is 'beating funny.' Her pulse is irregular. The flowers have tubular, bell-shaped blooms.
- Case 2: The Aquarium Enthusiast
  - A marine biologist cleaning a tank is pricked by what she thought was decorative coral. Within minutes, she experiences intense pain, swelling, and difficulty breathing. The 'coral' has moved slightly.
- Case 3: The Herbal Tea
  - An elderly man makes tea from plants in his garden, thinking they're comfrey. After drinking it, he develops severe abdominal pain, vomiting, and dark urine. His liver enzymes are elevated. The leaves looked similar but had small purple flowers.
- Case 4: The Exotic Pet
  - A college student is bitten while handling his new pet frog he ordered online. The frog is brightly colored, blue and yellow. Within an hour, he experiences numbness, muscle weakness, and difficulty breathing.
- Case 5: The Hiking Trip
  - A hiker brushes against a plant while on a trail. Within hours, she develops painful, blistering rashes in streaky lines on her arms and legs. The rash worsens over 2-3 days.
- Case 6: The Mushroom Forager
  - A family eats wild mushrooms collected from their yard. They seem fine for 6-8 hours, then develop severe vomiting and diarrhea. By day 3, they show signs of liver failure.
- Instructions
  - Identify the toxicant (specific plant/animal)
  - Classify the toxin type (alkaloid, glycoside, venom type, etc.)
  - Explain the mechanism of action (how it causes harm)
  - Identify target organ(s) affected
  - Propose treatment/management (antidote, supportive care, decontamination)
  - Suggest prevention strategies

 **Quiz #5**

Exit Ticket – Complete a Venn diagram OR write 3-4 sentences:

- How are plant toxins and animal venoms SIMILAR and DIFFERENT in terms of:
  - Purpose (why the organism makes them)
  - How they enter the body

- Treatment approaches

Week 6: Mechanisms of Toxicity – "How Poisons Work"

Objectives

- Describe the concept of molecular targets and how toxicants interact with biological macromolecules
- Identify the major categories of toxicological mechanisms (receptor-mediated, enzyme inhibition, cellular disruption, oxidative stress, genotoxicity)
- Explain oxidative stress and free radical damage
- Understand receptor-mediated toxicity
- Identify target organs and selective toxicity
- Analyze how the same toxicant can produce different effects through multiple mechanisms
- Evaluate adaptive responses that protect against toxicity versus those that exacerbate injury

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

Read

- *Mechanisms of Toxicity. Encyclopedia of Occupational Health & Safety Access Pharmacy*

Watch

- Mechanisms of Toxicity (~20 min)

Do

- Have you ever heard warnings about carbon monoxide, lead paint, or alcohol poisoning? Choose one and describe what you think happens in the body when someone is exposed.
- A person drinks a large amount of caffeine very quickly. Another person is exposed to a small amount of mercury over several months. Both experience toxic effects. Why do you think these two situations cause harm in such different ways?
- What do you think is the single most important factor that determines whether a substance becomes toxic?

Think - Why do you think understanding mechanisms of toxicity are important for healthcare, environmental science, or drug development?

IN-CLASS LEARNING/ACTIVITIES

 **Watch** clip: Dumbledore drinking the potion in the cave (Half-Blood Prince)

 **Discuss**

- Do all toxicants have a single mechanism, or can mechanisms change with dose?
- Why do some toxicants affect only certain cell types or organs while others cause systemic effects?
- How can the same receptor produce both therapeutic and toxic effects depending on context?
- Agonists versus antagonists: which is more likely to produce toxicity and why?
- Is oxidative stress a cause or a consequence of toxicity? Can it be both?
- The paradox of oxygen: essential for life but a source of damaging reactive species
- Antioxidant supplementation: protective strategy or potential for harm?
- Why did organisms evolve metabolic pathways that sometimes create more toxic products?

 **Activity**

- The Poisoning of Ron Weasley (watch clip)
  - Ron drinks poisoned mead meant for Dumbledore
  - Symptoms described in the book: convulsions, foaming at the mouth
  - Students work in groups to:
    - Hypothesize what type of poison it might be
    - Identify which cellular mechanisms might be affected
    - Explain why the bezoar worked as an antidote
    - Suggest real-world poisons with similar symptoms

 **Quiz #6**

 **Exit Ticket –** If two people are exposed to the same chemical but only one shows toxic effects, what mechanism-related factor might explain the difference? (metabolism, susceptibility, and biological variability)

 **Assignment #3** Making the Invisible Visible

Explore how scientists, public health officials, and communities make abstract chemical exposures concrete and understandable through data visualization and risk communication.

Review and Midterm (O.W.L.) Exam

- Select Topic and Environment for Course Project
  - Submit a 1-page (double-spaced) proposal outlining your chosen environment, the toxicological issue, and a preliminary list of 3-5 sources. Explain why this topic allows for advanced inspection beyond foundational concepts (e.g., delving into dose-response relationships, bioaccumulation, or synergistic effects of multiple toxins).

Week 8 Target Organ Toxicity (Liver & Kidney) – "The liver as a cauldron/Kidneys and filtration charms"

Objectives

- Explain why the liver and kidneys are particularly vulnerable to toxicant-induced injury
- Differentiate between the mechanisms of hepatotoxicity and nephrotoxicity based on cellular and biochemical pathways
- Identify anatomical and physiological features that concentrate toxicants in liver and kidney tissues
- Explain how hepatic metabolism can both detoxify and bioactivate xenobiotics
- Explain the role of cytochrome P450 enzymes in both detoxification and toxification
- Compare mechanisms of acute vs. chronic liver injury
- Explain idiosyncratic drug reactions and their unpredictability
- Identify why the proximal tubule is the most common site of nephrotoxic injury
- Describe glomerular, tubular, interstitial, and vascular targets of nephrotoxins
- Assess the effectiveness of current diagnostic biomarkers for early detection of hepatotoxicity and nephrotoxicity
- Propose strategies for mitigating toxicity through drug formulation or personalized medicine approaches

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

Read

- Desalegn H, Diaz LA, Rehm J, Arab JP. **Impact of alcohol use on liver disease outcomes**. Clin Liver Dis (Hoboken). 2024 Jun 7;23(1):e0192.
  - Examines how alcohol consumption affects the progression and outcomes of various liver diseases, providing evidence on the relationship between drinking patterns and liver health
- Bindu S, Mazumder S, Bandyopadhyay U. **Non-steroidal anti-inflammatory drugs (NSAIDs) and organ damage: A current perspective**. Biochem Pharmacol. 2020 Oct;180:114147.
  - Reviews how non-steroidal anti-inflammatory drugs (NSAIDs) can cause damage to various organs in the body, offering a perspective on their adverse effects beyond their therapeutic benefits.

Watch

- How your liver works (~2min)
- Liver failure (~2 min)
- How your kidneys work (~3 min)
- Target Organ Tox (~10 min)

Do

- **Which organ is at risk? (liver, kidney, both?)**
  - A drug is broken down into reactive metabolites - Liver
  - A chemical accumulates in the bloodstream - Both
  - A toxin is eliminated through urine - Kidney
  - A substance requires enzymes to be processed - Liver
  - A heavy metal binds to proteins in the filtration system - kidney
  - A compound damages cells involved in metabolism - Liver

Think – An individual takes a medication that is safe at normal doses but becomes dangerous when the liver is damaged. Another person is exposed to a solvent at work and develops kidney damage. What do these two situations tell us about the roles of the liver and kidneys?

IN-CLASS LEARNING/ACTIVITIES

Watch clip: The "Polyjuice Potion" Scenes (Chamber of Secrets, Deathly Hallows)

Discuss

- Why do some toxicants target liver while others target kidneys, and some target both?
- Why is the liver called the "metabolic workhorse" and how does this make it both resilient and vulnerable to toxicants?
- Direct hepatotoxicity versus idiosyncratic reactions: what distinguishes predictable from unpredictable liver injury?
- Bioactivation in the liver: when does metabolism protect versus harm?
- ALT and AST: what do they tell us about the pattern and severity of liver injury?
- Alcohol consumption and hepatotoxicity: synergistic effects and altered metabolism
- Why are the kidneys particularly vulnerable to toxicants despite being only 0.5% of body weight?
- The concept of renal blood flow and glomerular filtration: delivering toxicants to the kidneys
- Creatinine clearance and estimated GFR: assessing overall kidney function
  - Serum creatinine: strengths and limitations as a marker of kidney function
- Blood urea nitrogen (BUN): what it measures and when it's useful
- Urinalysis: proteinuria, hematuria, and cellular casts as indicators of injury
- Detoxification versus elimination: comparing organ functions and vulnerabilities

- The problem of polypharmacy and cumulative hepatotoxic risk

Activity

- **Potion Master's Toxicity Challenge**
  - Welcome to the Hospital Wing, Apprentice Healer, You are Madam Pomfrey, the esteemed matron of Hogwarts. A rash of reckless potion-brewing accidents has flooded your ward. Students have imbibed experimental brews and now exhibit signs of organ toxicity. Your mission: diagnose the primary organ affected, liver or kidneys, based on history, symptoms, and lab biomarkers. Cases get progressively more difficult.

Easy Case Example: The Lucky Gryffindor (Felix Felicis)

History: Drank Felix Felicis ("Liquid Luck") to ace Potions exam. Now giddy but jaundiced.
Symptoms: Nausea, right upper quadrant pain, yellow skin. **Labs:**

Biomarker	Patient Value	Normal Range
ALT (liver enzyme)	850 U/L	<50 U/L
AST (liver enzyme)	1200 U/L	<40 U/L
Creatinine (kidney)	0.9 mg/dL	0.6-1.2 mg/dL
BUN (kidney)	15 mg/dL	7-20 mg/dL

Medium difficulty Case Example: The Moody Hufflepuff (Wolfsbane Potion)

History: Wolfsbane Potion (for "werewolf cosplay"). Now nauseous, no full moon involved.
Symptoms: Metallic taste, reduced urination, hypertension.
Labs:

Biomarker	Patient Value	Normal Range
ALT	42 U/L	<50 U/L
AST	35 U/L	<40 U/L
Creatinine	4.1 mg/dL	0.6-1.2 mg/dL
BUN	88 mg/dL	7-20 mg/dL

More difficult Case Example: The Chatty Professor (Veritaserum)

History: Veritaserum slipped into tea during interrogation prank. Blurted secrets, now weak.
Symptoms: Confusion, mild jaundice, but normal urine output. (Confounder: Dehydration noted.)
Labs:

Biomarker	Patient Value	Normal Range
ALT	320 U/L	<50 U/L

AST	410 U/L	<40 U/L
Creatinine	1.4 mg/dL	0.6-1.2 mg/dL
BUN	28 mg/dL	7-20 mg/dL

Quiz#7

Exit Ticket – A new chemical compound is highly lipophilic (fat-soluble) and is only toxic after it has been chemically transformed into a new metabolite. Based on the primary functions of the two organs, explain why the liver is the most likely organ to be the site of initial damage, rather than the kidney.

Week 9 Target Organ Toxicity (Neuro) – "Mind Over Molecules"

Objectives

- Describe major classes of neurotoxic agents (e.g., heavy metals, solvents, pesticides) and their mechanisms of action
- Explain how neurotoxins alter neurotransmission, leading to changes in cognition, mood, and behavior
- Summarize the clinical manifestations of neurodegeneration caused by chronic toxin exposure
- Discuss how toxins penetrate the blood-brain barrier and the implications for central nervous system vulnerability
- Apply knowledge of neurotoxic mechanisms to predict clinical outcomes of exposure to specific agents
- Evaluate strategies for prevention, antidote use, and neuroprotective interventions in cases of neurotoxicity

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

Read

- Introduction to Neurotoxicity – An Overview, Science Direct

Watch

- Neurotoxins (~4 min)
- Intro to nervous system and target organ toxicity (Neuro) (~20 min)

Do

- **The Case of the Compromised Neuron**

- A patient is admitted to the hospital with a strange set of symptoms: muscle spasms, involuntary shaking (tremors), and difficulty coordinating movement.
- Neurological tests reveal that communication between their motor neurons and muscle fibers is severely disrupted. Specifically, when a signal is supposed to travel across the synapse, the signal is weak, erratic, and doesn't terminate properly. It appears the normal balance of chemical messengers (neurotransmitters) is completely thrown off.

1. Based on your knowledge of biology and the assigned lecture video, what is the most likely target of a substance causing these problems? (Choose one and briefly explain *why* it's the target).

    A. The Neuron's Nucleus (DNA/protein synthesis)
    B. The Myelin Sheath (insulation)
    C. The Synaptic Cleft and Receptors (communication)

    Hint: Spasms and tremors point to immediate signaling problems.

2. Once students complete 1. The answer is revealed as C. Students will then be directed to fill in the following table given the disruption mechanisms.

Disruption Mechanism	**Effect on the Signal**	**Resulting Symptom**
A. Toxin blocks Reuptake	Neurotransmitter (NT) stays in the synaptic cleft for too long, over-stimulating the receptor.	**Over-activation** (e.g., constant muscle contraction)
B. Toxin destroys NT vesicles	No Neurotransmitters are released into the synaptic cleft.	**Under-activation** (e.g., paralysis)
C. Toxin mimics the NT	The toxin binds to the receptor, causing an over-response or blocking the natural NT.	**Erratic/Excessive Signalling** (e.g., spasms, tremors)

Think - How does the nervous system's remarkable sensitivity to chemical signals make it both highly efficient and uniquely vulnerable to toxicants?

IN-CLASS LEARNING/ACTIVITIES

Watch clip: The Emerald Potion/Drink of Despair (Half-Blood Prince)

Discuss

- What makes the nervous system particularly vulnerable to toxic insult compared to other organ systems?
- How do physicochemical properties (lipophilicity, molecular size, charge) determine whether a toxin can cross the blood-brain barrier?
- Impact of dose
    - One can of tuna rarely causes issues, but 15 cans/week can → Minamata-like symptoms
    - 1–2 energy drinks are fine, but 10+ in a night ("caffeine intoxication psychosis") has sent students to the ER
- Fluoride in drinking water: At what point (if any) does neurotoxicity outweigh dental benefits?
- Microplastics and nanoplastics: Do we have enough evidence yet to be worried about their potential to carry neurotoxic chemicals across the blood-brain barrier?
- Why has translating neuroprotective agents from animal models to human clinical trials been so spectacularly unsuccessful (e.g., hundreds of failed stroke trials)?
- Should recreational drugs (MDMA, methamphetamine, cannabis concentrates) be evaluated primarily through the lens of neurotoxicity rather than addiction potential?
- Nature vs. human-made: Which has produced the most potent neurotoxins - nature (tetrodotoxin, saxitoxin, botulinum) or chemistry labs?
- If you had to rank the following by lifetime neurotoxic risk for the average person, what would your order be: alcohol, air pollution, recreational drugs, heavy metals, pesticides?

Activity

- **The Poisoned Goblet of Fire** - A Neurotoxicology Mystery
    - Students work in teams of 3-4, each representing a different "house" investigating a mysterious poisoning at Hogwarts
    - The Scenario:
        - Several students at a Hogwarts feast have fallen ill with varying neurological symptoms after drinking from enchanted goblets. The symptoms appeared at different times and vary in severity. Teams must identify which neurotoxin was in each goblet, explain the mechanism of action, and recommend treatment.
        - Each Team will have:
            - Case files with patient symptoms (tremors, paralysis, memory loss, seizures, visual disturbances, etc.)
            - Timeline cards showing onset of symptoms (immediate, hours later, days)
            - Toxin cards with clues about different neurotoxins (lead, mercury, organophosphates, botulinum toxin, tetrodotoxin, MPTP, etc.)
            - Mechanism of action reference sheets (simplified)

Part 1: "Gathering Evidence"

- Students review case files and match symptoms to potential toxins

- They must consider: route of exposure, time to onset, affected neural systems
- Use their "Marauder's Map" handout showing neural pathways to trace where damage occurred

Part 2: "Consulting the Restricted Section"

- Teams research their suspected toxins using provided materials or internet searches
- Identify: mechanism of action, target receptors/pathways, and why certain symptoms appeared
- Complete a "Diagnosis Scroll" with their findings

Part 3: "The Antidote Challenge"

- Teams propose treatment strategies based on their identified toxin
- Explain WHY their antidote works (e.g., atropine for organophosphate poisoning blocks excess acetylcholine)

Part 4: "The Wizengamot Trial"

- Each team presents their case to the class
- Other teams can challenge findings or ask questions

Example Case Card:

- "Patient: Neville Longbottom
- Symptoms: Progressive weakness starting in facial muscles, spreading downward; difficulty swallowing; normal mental status; pupils reactive
- Onset: 18-36 hours after feast
- Other clues: Several students affected; all ate the same canned pumpkin pasties"
- (Answer: Botulinum toxin - blocks acetylcholine release at neuromuscular junction)

- Alternative formats:
  - Competitive Version: "Triwizard Tournament" style with timed challenges and point scoring
  - Collaborative Version: Each team investigates one patient, then must work together to identify if there's a single source or multiple toxins

 **Quiz**

 **Exit Ticket –** What is the most important idea you learned today about how neurotoxins affect the nervous system?

Week 10 Target Organ Toxicity (Respiratory) – "Dementors of Dust"

Objectives

- Describe the structure and function of the respiratory system relevant to toxicant exposure (e.g., airway anatomy, alveolar-capillary interface).

- Explain key mechanisms by which respiratory toxicants affect the airway and lung (e.g., inflammation, oxidative stress, impaired gas exchange).
- Identify major classes of respiratory toxicants and provide examples of common exposure sources (e.g., particulate matter, ozone, industrial chemicals, tobacco smoke).
- Compare acute and chronic respiratory responses to toxicant exposure, including irritation, bronchoconstriction, fibrosis, and carcinogenesis.
- Interpret basic toxicological data (e.g., dose–response, epidemiological findings) to assess respiratory risk.

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

Read

- Toxic Effect on Respiratory System, 1 page

Watch

- Toxicology of Tobacco Smoke (~ 3 min)
- Intro to respiratory system and respiratory toxicology (~20 min)

Do

- A student brewed a potion incorrectly, producing toxic vapors that spread through the Potions classroom.

  1. Which part of the respiratory system do you think is most vulnerable to immediate exposure to corrosive fumes?
  2. Which part is most at risk from fine particulate toxins?
  3. Why is knowing the type of toxicant important for treating exposure?

- Below are three lists. Draw a line or use letters/numbers to connect the appropriate items from Column A, B, and C to create a complete and accurate "Toxicology Sort."

Column A: Magical Contaminant (Toxicant)	**Column B: Hazard Class (Route/Type of Exposure)**	**Column C: Muggle Malady (Pathology/Disease)**
1. Basilisk Venom Fumes (Extremely reactive chemical gas)	**A. Particulate Inhalation (The Floating Dust)**	**I. Asthma/Airway Hyper-reactivity** (Narrowing of airways due to inflammation)
2. Grindelwald's Gritty Gold (Insoluble, fibrous mineral dust)	**B. Chemical Asphyxiant (The Breath Thief)**	**II. Pulmonary Fibrosis** (Irreversible scarring/stiffening of the lung tissue)
3. Mandrake Root Vapors (Low levels of a colorless, odorless gas that binds to blood)	**C. Irritant Gas (The Corrosive Cloud)**	**III. Hypersensitivity Pneumonitis** (Allergic inflammation of the alveoli)
4. Puking Pastille Powder (Finely ground, allergenic organic material)	**D. Immune Sensitizer (The Allergic Jinx)**	**IV. Carbon Monoxide Poisoning** (Tissue oxygen deprivation leading to system failure)

Sorting Hat's Clues

- **The Breath Thief** does not damage the lungs directly but stops oxygen from reaching the rest of the body.
- **The Corrosive Cloud** is highly reactive and burns or irritates the tissue it touches, especially the sensitive linings of the airways.
- **The Floating Dust** is difficult for the lungs to clear, and, over time, causes a major, stiffening structural change.
- **The Allergic Jinx** involves the immune system overreacting to a repeated, harmless substance, causing the airways to swell and spasm.

Think

- If the primary function of the respiratory system is to take things *in* (oxygen), how does that very design, with its massive surface area, thin barriers, and constant flow, also make it the body's most vulnerable entryway for poisons?

IN-CLASS LEARNING/ACTIVITIES

Watch clip: Draught of Living Death scene (potions class sopophorous bean) **(Half-Blood Prince**)

Discuss

- Why is the respiratory tract more susceptible to toxicants compared to other organ systems?
- What role does oxidative stress play in the progression of respiratory diseases caused by toxicants?
- How do acute exposures (e.g., chlorine gas) differ mechanistically from chronic exposures (e.g., cigarette smoke)?
- Can adaptive responses (like increased mucus production) become maladaptive over time?
- How should public health policy balance risks from environmental pollutants (e.g., smog, ozone) versus occupational hazards (e.g., asbestos, silica)?
- How does vaping compare to traditional smoking in terms of toxicological impact on the lungs?

Activity

- Each group receives a case scenario card describing an exposure situation.
- Examples:
  - **Case A:** Factory worker exposed to silica dust for 10 years.
  - **Case B:** Child living near a highway with high particulate matter.
  - **Case C:** Emergency responder exposed to chlorine gas during an industrial accident.
  - **Case D:** Young adult using vaping devices daily for 5 years.

- **Group Tasks:**

    1. Identify the likely toxicant(s).
    2. Explain the mechanism of injury (e.g., oxidative stress, fibrosis, inflammation).
    3. Predict short-term and long-term respiratory outcomes.
    4. Suggest diagnostic tools and preventive measures.

Quiz

Exit Ticket – If you were a public health official, what single intervention would you prioritize to reduce respiratory toxicant exposure in your community?

Week 11 Non-Organ-Directed Toxicity (NODT) - "Dark Magic and Cancer"

Objectives

- Recognize toxic effects not confined to a single organ, e.g., carcinogenesis, mutagenesis, teratogenesis, immunotoxicity.
- Describe the major mechanisms underlying NODT, such as oxidative stress, mitochondrial dysfunction, immune-mediated effects, and genotoxicity.
- Identify key molecular pathways involved in generalized toxic responses (e.g., inflammation, apoptosis, necrosis, ER stress).
- Interpret how reactive metabolites, electrophilic compounds, or free radicals contribute to non-organ specific damage.
- Evaluate case studies of well-characterized non-organ directed toxicants (e.g., benzene, ionizing radiation, certain metals, chemotherapeutics).
- Differentiate between developmental toxicity, teratogenicity, and reproductive toxicity, with examples.

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

Read

- Casarett & Doull's Essentials of Toxicology; Chemical Carcinogenesis, select pgs
- Casarett & Doull's Essentials of Toxicology; Genetic Toxicology, select pgs
- Casarett & Doull's Essentials of Toxicology; Developmental Toxicology, select pgs
- Miller LB, Feuz MB, Meyer RG, Meyer-Ficca ML. **Reproductive toxicology: keeping up with our changing world.** Front Toxicol. 2024 Oct 11;6:1456687.

Watch

- Non-organ directed toxicology (~20 min)

Do

- The goal of non-organ directed toxicology is to study toxic effects that don't primarily manifest as failure or structural damage in a major, single organ (like hepatic failure or kidney necrosis).
  - Part 1: Scenario Analysis - A Toxicologist's Dilemma
    - Imagine you are a toxicologist reviewing a new industrial chemical. Initial in vitro (test tube) and in vivo (animal) studies show no significant damage to the liver, kidneys, or lungs at expected exposure levels. However, you notice a few concerning trends across the data:

      1. Unexpected Cell Behavior: Cells in culture are showing an increased rate of uncontrolled division and some DNA damage after exposure.
      2. Blood Irregularities: Animal studies show a reduction in the number of circulating red blood cells and an altered function of white blood cells.
      3. Hormonal Changes: There are subtle, yet measurable, changes in the levels of several reproductive hormones in exposed animals, particularly affecting fertility.

- Activity: Read the three observations above. For each observation, discuss and write down:
  - A. Which major organ system (if any) is the *primary* target of concern?
  - B. What type of non-organ directed toxic effect might be occurring (e.g., genetic, cellular, systemic)?

Observation	A. Primary Organ System Targeted	B. Possible Non-Organ Directed Toxic Effect
1. Cell Behavior (Uncontrolled division, DNA damage)		
2. Blood Irregularities (Reduced RBCs, altered WBCs)		
3. Hormonal Changes (Altered reproductive hormones)		

- Activity: Based on your analysis in Part 1 and your general understanding of biology, attempt to define the following key terms. These represent the major domains of non-organ directed toxicology:

  1. Genotoxicity:
  2. Carcinogenesis:
  3. Hematotoxicity:
  4. Immunotoxicity:
  5. Reproductive/Developmental Toxicity (Teratogenesis):

- Overlaps: Can a single chemical cause both a traditional organ-directed effect (e.g., liver damage) and a non-organ directed effect (e.g., genotoxicity)? Give an example if you can think of one.

Think

If a chemical is not damaging the major organs (like the liver, kidney, or heart) in a measurable way, how can it still be harmful to the organism as a whole, and what biological systems might be silently under attack?

IN-CLASS LEARNING/ACTIVITIES

Watch clip: The Basilisk Venom and Phoenix Tears (Chamber of Secrets)

Discuss

- Why do we often dismiss "non-organ-directed" toxicity as less important than organ-specific damage, when in reality it may affect every patient or exposed individual first?
- At what point does a toxic effect stop being "non-specific" and become organ-directed? (e.g., Is fatigue from carbon monoxide truly non-specific, or is it always brain hypoxia in disguise?)
- Paracelsus revisited: In non-organ-directed toxicity, is the concept of "dose makes the poison" even more critical than in target-organ toxicity? Why or why not?
- Cyanide is lethal within minutes yet has no single target organ—why is it the ultimate example of non-organ-directed toxicity despite acting on a specific enzyme (cytochrome c oxidase)?
- In a multiple-chemical industrial spill, why are the first symptoms reported by workers almost always non-specific (headache, nausea, dizziness) regardless of the chemicals involved?
- Alcohol hangover: the prototypical reversible non-organ-directed toxicity—why do we tolerate it socially when similar symptoms from chemicals would trigger hazard labeling?

Activity

1. Sorting Hat Scenario

- Students are "sorted" into four houses, each representing a toxicological effect:
    - Gryffindor → Carcinogenesis (courage to face cancer risks)
    - Ravenclaw → Mutagenesis (wisdom in genetic changes)
    - Hufflepuff → Teratogenesis (loyalty to protecting developing life)
    - Slytherin → Immunotoxicity (cunning immune system manipulations)

2. Potion Mishaps Case Studies

- Each house receives a "Potion Mishap Scroll" describing a magical scenario that parallels a toxicological effect:

- Carcinogenesis (Gryffindor): A wizard accidentally brews a potion with dragon blood that causes uncontrolled cell growth. *Task:* Identify real-world carcinogens (e.g., benzene, aflatoxin) and explain how they cause systemic effects.
- Mutagenesis (Ravenclaw): A spell gone wrong alters DNA sequences in magical creatures. *Task:* Discuss mutagens (e.g., radiation, alkylating agents) and their long-term consequences.
- Teratogenesis (Hufflepuff): A pregnant witch drinks a potion with mandrake root, leading to developmental abnormalities in the fetus. *Task:* Identify teratogens (e.g., thalidomide, alcohol) and explain critical exposure windows.
- Immunotoxicity (Slytherin): A cursed cauldron releases vapors that weaken the immune system. *Task:* Explore immunotoxic agents (e.g., dioxins, heavy metals) and their systemic impact.

 **Quiz**

 **Exit Ticket –** What's one thing that still confuses you about non-organ directed toxicity, or one question you still have?

Week 12 Forensic Toxicology: Love Potions, Truth Serums – "Interrogation Agents of the Wizarding World"

 **Objectives**

- Classify psychoactive substances by mechanism of action: depressants, stimulants, hallucinogens, dissociatives, and cannabinoids
- List major categories of club drugs including MDMA (ecstasy/molly), GHB, ketamine, rohypnol, and methamphetamine
- Describe the pharmacokinetics and pharmacodynamics of each major club drug class
  - Explain receptor targets and neurotransmitter systems affected by major psychoactive substance classes
- Identify characteristic clinical presentations and toxidromes associated with club drug intoxication
- Recognize the particular risks of polydrug use and drug adulteration commonly seen with club drugs
- Assess addiction potential, tolerance development, and withdrawal risks for different substance classes
- Analyze the public health implications of novel psychoactive substances (NPS) and emerging synthetic drugs
- Define interrogation agents and describe their historical use in intelligence gathering and law enforcement contexts
- Identify common substances used as "truth serums" including barbiturates (sodium pentothal, sodium amytal), benzodiazepines (midazolam), and anticholinergics (scopolamine)

- Explain the pharmacological mechanisms by which interrogation agents affect cognition, memory, and executive function
- Evaluate the ethical, legal, and human rights implications of using pharmacological interrogation methods

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

Read

- Winter A. *The making of "truth serum*. Bull Hist Med. 2005 Fall;79(3):500-33.
  - Explores the historical development of so-called "truth serums" (drugs like scopolamine and sodium pentothal), examining how they were created, tested, and used in interrogation and psychiatric contexts during the early-to-mid 20th century.
- What is Truth Serum, Scientific American, 2008
- **Narcoanalysis: The Science Behind Truth Serums**

Watch

- The truth about truth serum (~4 min)
- Psychoactive substances (~2 min)
- Love potions and truth serums (~20 min)

Do

- Empathy-Enhancing Substances: Science Meets Fiction
  - Part 1: Real-World Empathy-Enhancing Substances
    - Some psychoactive substances are known to increase feelings of empathy, emotional openness, and social connection. Read about these substances below:
      - MDMA (3,4-Methylenedioxymethamphetamine) - Common name: Ecstasy, Molly
        - Effects: Increases release of serotonin, dopamine, and oxytocin. Users report enhanced empathy, emotional warmth, reduced fear responses, and increased desire for social connection.
        - Medical research: Currently being studied in FDA-approved clinical trials for PTSD treatment due to its ability to help patients process trauma with reduced fear.
        - Risks: Neurotoxicity with heavy use, dehydration, hyperthermia, potential for addiction.
      - Oxytocin - Common name: "Love hormone" or "cuddle hormone"
        - Effects: A naturally occurring hormone that increases trust, bonding, and prosocial behavior. Released during physical touch, childbirth, and intimate moments.
        - Medical research: Being studied for autism spectrum disorders and social anxiety.
        - Risks: Can increase in-group favoritism and out-group prejudice; effects are context-dependent.

- Psilocybin
  - Common name: Magic mushrooms
  - Effects: Can produce feelings of interconnectedness, emotional openness, and dissolution of ego boundaries. Users often report increased compassion.
  - Medical research: Being studied for depression, anxiety, and addiction treatment.
  - Risks: Psychological distress, potential for "bad trips," not suitable for those with psychotic disorders.

- Part 2: Harry Potter's Love Potion
  - Amortentia
    - The most powerful love potion in the wizarding world. It creates powerful obsession rather than genuine love. It has a distinctive mother-of-pearl sheen and steam rises in spirals. The potion smells different to each person according to what attracts them.
    - Key examples in the series:
    - Voldemort's mother (Merope Gaunt) used a love potion on Tom Riddle Sr.
    - Romilda Vane attempted to give Harry love potion-laced chocolates
    - Ron accidentally consumed love potion meant for Harry
    - Important note: Love potions are portrayed as problematic in Harry Potter because they remove consent and create artificial feelings rather than genuine emotion.

- Part 3: Comparison Activity

Aspect	Real Empathy Enhancers	Harry Potter Love Potions
Primary Effect	Enhance existing emotions and empathy; increase openness	Create artificial obsession and infatuation
Authenticity	Amplify genuine feelings; user remains themselves	Completely fabricated feelings; removes free will
Duration	Temporary (hours); effects fade naturally	Lasts as long as potion is administered
Consent Issues	User chooses to take substance (when used properly)	Typically given without target's knowledge

- Part 4: Think
  - What is the key difference between enhancing empathy and creating artificial love? Why is consent crucial in both scenarios?
  - MDMA is being researched for PTSD therapy in controlled medical settings. How is this different from recreational use or the unethical use of love potions in Harry Potter?
  - If a substance could genuinely make people more empathetic without removing their free will, would there be ethical ways to use it? What safeguards would be necessary?

Think

- With regard to love potions and interrogation agents, are people under the influence of these substances more vulnerable to manipulation?
- If our emotions can be chemically influenced, what makes a feeling "authentic"? And who gets to decide when it's okay to change how we feel?

IN-CLASS LEARNING/ACTIVITIES

Watch clip: Ron and the Love Potion (Half-Blood Prince)

Discuss

- If you take MDMA and feel deep empathy for someone, is that feeling 'real'?
- Does the chemical origin of a feeling make it less valid? What about coffee making you more alert or antidepressants helping with mood?
- Rank these scenarios from most to least ethical:
    - Taking MDMA yourself at a party
    - A therapist giving you MDMA in a controlled setting for PTSD
    - Someone spiking your drink with MDMA without telling you
    - Giving yourself a love potion to fall for someone you think is good for you
    - Someone giving you a love potion without your knowledge"
- MDMA is being studied for PTSD treatment and may become FDA-approved. Why might we accept 'empathy drugs' for medical use but not recreational use?
- Do we treat physical and mental health medications differently? Should we?
- We accept caffeine to enhance alertness and some people take Adderall to enhance focus. Should we accept substances that enhance empathy? What makes emotions different from cognitive functions?
- Is there a moral dimension to emotional enhancement that doesn't exist for cognitive enhancement?
- Some people argue that using substances for empathy or happiness is 'cheating' or 'taking a shortcut.' Others say that suffering isn't noble and we should reduce it by any safe means available. Is there value in experiencing difficult emotions naturally? If a substance could make you more empathetic permanently with no side effects, would that change your view?
- Imagine empathy-enhancing drugs become common at social events (like alcohol is now). You're at a party where everyone else has taken one, and they're all having deep, meaningful conversations. You haven't taken it. Would you feel pressure to take it? How is this similar to or different from alcohol culture? Could this create a society where "natural" empathy is seen as insufficient?
- When you're more empathetic and emotionally open, you're also more vulnerable to manipulation. Think about Ron under the love potion, he was completely vulnerable to

Romilda Vane's influence. Does enhanced empathy necessarily mean reduced judgment?

- Your personality is partly determined by your neurochemistry. When you change your neurochemistry, are you becoming more 'yourself' or less 'yourself'?
    - Someone with depression taking antidepressants: Are they more themselves when medicated or unmedicated?
    - Someone naturally low in empathy taking an empathy-enhancer: Is their enhanced empathetic state 'fake'?, Where is the 'real you' located?
- Is this more like physical therapy (helping you heal) or a performance-enhancing drug (artificial improvement)?
- What if it works? Does the method matter if the outcome is genuine reconnection?
- What makes the brain's self-produced chemicals (dopamine, oxytocin, etc.) more 'authentic' than externally introduced ones?"
    - Is "natural" always better? (poison ivy is natural)
    - We accept medical intervention for physical health, why not mental/emotional?
    - Where do we draw the line between therapy and enhancement?

- In-class Assignment: It's 2050 and empathy-enhancing drugs are as common as antidepressants. Write a short story or essay: How has society changed? What problems have been solved? What new problems have emerged?"
    - Consider:
        - **Autonomy** (freedom to alter our consciousness) vs. **Protection** (preventing harm/exploitation)
        - Authenticity (natural emotions) vs. Wellbeing (reducing suffering)
        - Individual benefit (helping people) vs. Social consequences (changing cultural norms)
        - Is there a way to balance all of these, or do we have to prioritize some values over others? How would you design a policy that respects all these concerns?"

Interrogation Agents and Truth Serums

- What were the goals and methods of CIA programs like MK-ULTRA that tested LSD and other substances for interrogation purposes?
- What role have pharmacological agents played in the history of intelligence gathering across different nations?
- How do substances like LSD, sodium pentothal, and scopolamine actually affect cognition, memory, and truthfulness?
- Is there scientific evidence that these agents reliably produce truthful information?
- What are the neurological mechanisms that make someone more suggestible or talkative under certain substances?
- Can drugs actually compel someone to tell the truth, or do they simply lower inhibitions?
- How do factors like dosage, individual physiology, and setting affect outcomes?
- How do polygraphs, brain imaging (fMRI), and other technologies compare to chemical agents?

- What does the concept of a "truth serum" reveal about our understanding of consciousness and volition?
- You're designing interrogation policy for a democratic nation. What guidelines would you establish regarding the use of any substances in questioning?
- Researchers develop a highly reliable truth-verification technology. Under what circumstances, if any, should it be deployed in criminal or intelligence contexts?

 **Activity**

- Imagine scientists have developed a pill that makes people feel significantly more empathetic, kind, and emotionally connected to others for about 6 hours. The effects are temporary and wear off completely. While under its influence, people report feeling more understanding of others' perspectives, more emotionally open, and more caring, but they remain fully conscious and in control of their actions.
- Consider these situations and jot down your initial reactions:
    - Situation 1: Personal Use
        - Would you take this pill before:
            - A difficult conversation with a family member?
            - A first date?
            - Meeting someone you've had conflict with?
        - Quick reflection: What feels okay versus uncomfortable about using it? Why?
    - Situation 2: The Choice
        - You find out someone gave you this pill without telling you before an important conversation. The conversation went amazingly well, you felt so connected and understanding. But now you learn your feelings were chemically enhanced.
            - How do you feel about this? Were your emotions "real"? Does it matter that you didn't consent?

 **Quiz**

 **Exit Ticket –** Write one question you're still thinking about after today's lesson. It doesn't have to have an answer.

Week 13 Environmental Toxicology - "Death Eaters & Death Molecules"

 **Objectives**

- Identify major classes of enviromental toxins (e.g. heavy metals, pesticides, air pollutants, endocrine disruptors)

- Analyze real-world examples of environmental contamination (e.g., lead in water, mercury in fish, air pollution events).
- Evaluate the ecological and human health impacts of toxicant exposure in specific scenarios.
- Propose strategies for prevention, mitigation, and remediation of toxicological risks.

- Reflect on the importance of interdisciplinary approaches (biology, chemistry, policy, sociology) in addressing toxicological challenges.

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

Read

- **https://www.routledge.com/rsc/downloads/2._10.1201_9781315117867-1_(1).pdf Introduction to Environmental toxicology pgs 1-8**
- Shetty SS, Deepthi D, et. Al. *Environmental pollutants and their effects on human health*. Heliyon. 2023 Aug 25;9(9):e19496.
    - Provides scientific evidence on how environmental pollutants impact human health in everyday settings like homes, workplaces, and communities
- Adams C, Brown P, et. al. *Disentangling the exposure experience: the roles of community context and report-back of environmental exposure data*. J Health Soc Behav. 2011 Jun;52(2):180-96
    - Examines how community members learn about chemicals in their bodies and everyday environments, showing that technical content and lived experience are intertwined as well as how toxicology education can integrate out-of-classroom experiences with academic knowledge across multiple disciplines

Watch

- Alligators can teach us about adverse effects of chemical pollution | Scott M. Belcher | TEDxBoston (2025)

Do

- **Scenario A: The Community Garden**
    - A neighborhood wants to start a community garden on an empty lot that was previously a gas station 30 years ago. Soil testing reveals elevated levels of petroleum products.
        - What potential risks might exist for growing food here?
        - How might contaminants move from soil into plants and then into people?
        - What information would you need to decide if this site is safe?
- **Scenario B: The "Dose Makes the Poison"**
    - Fluoride is added to drinking water to prevent tooth decay. At low concentrations (0.7 mg/L), it's beneficial. At high concentrations (4+ mg/L), it can cause health problems.
        - Why can the same substance be both helpful and harmful?
        - What does this tell you about how we should think about "toxins"?
        - Can you think of other examples where dose matters?

- **Scenario C: Pesticide Runoff**
  - After heavy rain, pesticides from farm fields wash into a nearby stream. Fish in the stream show abnormal behavior, and birds that eat the fish have thinner eggshells.

    - Trace the path: How did pesticides affect organisms that were never directly sprayed?
    - What does this example show about how toxins move through ecosystems?
    - Who should be responsible for preventing this type of pollution?

Questions to keep in mind:

1. How do scientists determine whether a substance is toxic?
2. What makes some organisms more vulnerable to toxins than others?
3. How can we balance the benefits and risks of chemicals in our environment?
4. What role do individuals, industries, and governments play in preventing toxic exposures?

Think

- Why do we use chemicals we know can be harmful?
- What's more dangerous: a large exposure to something mildly toxic, or a tiny exposure to something highly toxic?
- Is 'natural' the same as 'safe'?

IN-CLASS LEARNING/ACTIVITIES

Watch clip: **The Emerald Potion Scene (Half-Blood Prince)**

Discuss

Scenario: Water fluoridation prevents tooth decay at 0.7 mg/L but causes dental fluorosis at higher levels. Coffee contains caffeine—beneficial for alertness but toxic at high doses. Even water can be lethal if you drink too much too quickly.

- If everything can be toxic at some dose, how do we decide what's "safe"?
- Who should set the acceptable exposure limits for communities?
- Should warnings be required on all products, even beneficial ones like vitamins or caffeine?
- How do you personally decide what level of risk is acceptable in your life?

Scenario: Mercury levels in fish:

- Plankton: 0.01 ppm
- Small fish: 0.1 ppm
- Medium fish: 1 ppm

- Large predatory fish (tuna, swordfish): 10 ppm
- Pregnant women are advised to limit tuna consumption, but tuna fishing is a major industry.

    - Why does mercury concentrate as you move up the food chain?
    - Should we ban fishing for species with high mercury, or just warn consumers?
    - If you're a pescatarian or rely on fish for protein, how do you balance nutrition with toxin exposure?

Scenario: The average person uses 9-15 personal care products daily, exposing themselves to over 100 unique chemicals. Most are tested individually but not in combination. Phthalates, parabens, and PFAS ("forever chemicals") are found in many common products.

- Should companies be required to prove products are safe before selling them, or should products be allowed until proven harmful?
- If a chemical might be harmful but the evidence isn't conclusive, should you avoid it?
- How do you balance convenience, cost, and potential health risks in product choices?
- Is it fair to place the burden of research on consumers, or should regulation be stronger?
- Would you pay significantly more for products certified free of questionable chemicals?

Scenario: A factory operated legally from 1950-1980, following all regulations at the time. It's now closed, but the soil is contaminated with lead and PCBs. Cleanup costs $50 million.

- Who should pay: the defunct company, its former owners, taxpayers, or current property owners?
- If the company followed the law at the time, can they be held responsible for harm we now understand?
- Should there be a statute of limitations on environmental damage?
- What if the contamination is making nearby residents sick right now, does that change your answer?

Scenario: Pesticides increase crop yields, reduce food costs, and prevent crop loss to pests. They also contaminate water, harm beneficial insects like bees, and leave residues on food. Organic farming uses fewer synthetic pesticides but requires more land and often costs more.

- Can we feed a growing global population without pesticides?
- Is it more ethical to use pesticides that increase food access but harm ecosystems, or avoid them and risk food scarcity?
- If you're a farmer whose livelihood depends on crop success, how do you make this choice?
- Should developing countries have access to pesticides banned in wealthy nations if it means food security?
- What responsibility do consumers have in this system?
- Answer these questions putting yourself in the role of a farmer, consumer, environmental scientist, public health official

Scenario: Chemicals are typically tested individually, but we're exposed to mixtures. Sometimes combinations are more toxic than individual chemicals (synergistic effects). We don't fully understand these interactions.

- If Chemical A is safe and Chemical B is safe when tested alone, but together they're harmful, who's responsible?
- How can we possibly test every combination of chemicals we might encounter?
- Should this uncertainty make us more cautious about chemical exposures overall?
- Is it possible to live in a modern world while avoiding chemical mixtures?
- What level of uncertainty are you comfortable with regarding your health?

Scenario: As permafrost melts, ancient bacteria, viruses, and stored pollutants like mercury are being released. Warmer temperatures allow disease vectors like mosquitoes to spread to new regions. Wildfires release stored toxins from soil and burned materials.

- How does climate change create new toxicological challenges we haven't faced before?
- Are these risks avoidable, or are they now inevitable consequences we must adapt to?
- What happens when toxins we thought were "safely contained" become mobile again?
- How do we prepare for toxicological threats we can't yet predict?

Scenario: Scientists discover that a widely used food additive may increase cancer risk by 2% over a lifetime. The evidence isn't conclusive. Announcing it could cause panic and economic harm; hiding it denies people information to make choices.

- When should the public be informed about potential but uncertain risks?
- How do we communicate risk without causing unnecessary fear?
- Do people have a right to know about all potential exposures, even minor ones?
- Who decides what information the public can handle?
- How would you want to be informed if you were the consumer?

Consider:

1. Would you rather know your exact lifetime exposure to toxins, or remain unaware?
2. If a product is 99% safe, is that good enough? What about 90%? Where's your line?
3. Is your smartphone worth the toxic mining waste created to extract rare earth elements?
4. If you could eliminate one environmental toxin completely, which would it be and why?

Activity

- **Part 1: The Mystery Illness**
    - Welcome, Environmental Toxicologists! The town of Riverside (population 15,000) has reported unusual health symptoms over the past 6 months:

        - 45 residents report persistent headaches and fatigue
        - 12 children have elevated lead levels in blood tests
        - 8 adults have developed skin rashes
        - Local fish in the river show fin deformities
    - Your team has been hired to investigate the source and recommend actions.

Investigation Data Provided

Potential Sources:

1. **Old Paint Factory** (closed 20 years ago)
    - Site soil tests: Lead = 800 ppm, Mercury = 15 ppm
    - Located 0.5 miles upstream from town water intake
2. **Current Agricultural Fields**
    - Pesticide use: Atrazine applied monthly during growing season
    - Runoff enters river during heavy rain
3. **Highway Expansion Project**
    - Diesel exhaust, construction dust
    - Began 6 months ago, located near 3 neighborhoods
4. **Municipal Water Treatment Plant**
    - Treating water from river
    - Old lead pipes in some neighborhoods (built 1960s-1980s)

- **Task A: Match Symptoms to Sources** Create a table matching each health symptom to the most likely toxin source(s). Explain your reasoning.

Symptom	Most Likely Source(s)	Why?
Elevated lead in children		
Headaches and fatigue		
Skin rashes		
Fish deformities		

Task B: Identify Routes of Exposure For each source, identify how toxins could reach residents:

- Inhalation (breathing)
- Ingestion (eating/drinking)
- Dermal absorption (skin contact)

Task C: Determine Priority Risk Rank the sources from highest to lowest priority for immediate action. Consider:

- Severity of health effects
- Number of people affected
- Vulnerability of exposed populations (children vs. adults)
- Feasibility of controlling exposure

Part 2: Dose-Response Investigation, Understanding LD50

You're testing a new pesticide's toxicity. In lab studies on rats (250g body weight), you get these results:

Dose (mg/kg)	# Rats Tested	# Rats Died
10	20	0

Dose (mg/kg)	# Rats Tested	# Rats Died
25	20	2
50	20	5
75	20	11
100	20	15
150	20	19
200	20	20

Your Team's Tasks

Task A: Calculate Mortality Percentages Calculate the % mortality for each dose:

Example: 25 mg/kg → 2 deaths ÷ 20 rats = 10% mortality

Task B: Create a Dose-Response Curve Graph the data:

- X-axis: Dose (mg/kg)
- Y-axis: % Mortality
- Plot the points and draw a line connecting them

Task C: Estimate LD50 Based on your graph, estimate the LD50 (dose that kills 50% of test subjects)

Task D: Apply to Humans This pesticide is being considered for home garden use:

1. **Human dose calculation**: If the rat LD50 is approximately 75 mg/kg, what dose would be lethal for a 70 kg human?
2. **Safety factor**: Regulators typically use a safety factor of 100 for pesticide exposure limits. What would be the "acceptable daily exposure" for an adult?
3. **Risk assessment**: The pesticide label says "Apply 10 ml per square meter." If someone accidentally gets 1 ml on their skin and absorbs 10% of it, and the solution contains 5 mg/ml:
    - How much enters their body? _____ mg
    - Is this dangerous for a 70 kg person? Why or why not?

Task E: Make a Recommendation Should this pesticide be approved for home use? Write a short paragraph supporting your decision with evidence from your calculations.

 **Quiz**

 **Exit Ticket**

 Assignment #4

- A news article says a chemical was found in drinking water. What 3 questions would you ask before deciding if you should be concerned?
- Your friend says they only buy 'all-natural' cleaning products because 'natural means safe.' Using your knowledge of toxicology, write a response.

Week 14: Pharmaceutical Toxicology – "Muggle Elixirs and their Lethal Limits"

Objectives

- Describe the drug development process and safety assessment phases from preclinical studies through post-marketing surveillance
- Calculate therapeutic index and interpret its significance for drug safety
- Evaluate drug interactions that may increase toxicity risk
- Identify populations at higher risk for adverse drug reactions (pediatric, geriatric, pregnancy, genetic polymorphisms)
- Define key drug safety terminology including adverse drug reactions (ADRs), adverse drug events (ADEs), medication errors, and pharmacovigilance
- Differentiate between Type A (predictable) and Type B (unpredictable) adverse drug reactions
- Analyze case studies to identify potential drug-induced toxicities and their mechanisms

- Describe monitoring strategies to detect early signs of toxicity
- Evaluate the benefit-risk ratio when making therapeutic decisions
- Recognize high-alert medications and situations requiring enhanced safety monitoring
- Interpret drug safety communications, black box warnings, and Risk Evaluation and Mitigation Strategies (REMS)
- Identify common types and causes of medication errors across the prescribing, dispensing, and administration process

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

Read

- Gilbert, S.G. (2020). *A Small Dose of Toxicology: The Health Effects of Common Chemicals (3rd ed.). CRC Press. Chapter 7-10.*
- Larsson, D.G.J., Flach, CF. *Antibiotic resistance in the environment*. Nat Rev Microbiol 20, 257–269 (2022).
    - Discusses how pathogens recurrently acquire new resistance factors from environmental bacteria, reducing our ability to prevent and treat bacterial infections

Watch

- Pharmaceutical toxicology (~20 min)

Do

- What Makes Medicine Safe?
  - Scenario 1: A bottle of aspirin says 'Take 2 tablets every 4-6 hours as needed. Do not exceed 8 tablets in 24 hours.' Why do you think there's a maximum limit? What might happen if someone took 20 tablets?
  - Scenario 2: Some medications have labels warning not to consume grapefruit or grapefruit juice. Why would a fruit interact with medicine?
  - Scenario 3: Children's medications are often dosed differently than adult versions of the same drug. A 5-year-old and an adult both have a fever, but the child gets 5mL while the adult gets 15mL. Why can't they just take the same amount?
  - Scenario 4: A pharmaceutical company recalls a medication because trace amounts of an impurity were found. The amount is tiny, parts per million. Why would such a small amount matter?

Think

- How does your body know the difference between a helpful drug and a harmful toxin, or does it?
- If a medication saves 1,000 lives but seriously harms 10 people, is it safe?
- Why can the same medication cure one person and make another person sick?

- What factors do you think determine whether a drug is safe or harmful?

IN-CLASS LEARNING/ACTIVITIES

Watch clip: The Antidote Scene (Half-Blood Prince)

Discuss

- A new cancer drug extends life by an average of 3 months but causes severe side effects in 40% of patients. Should it be approved? What if it were for a less serious condition like acne?
- Oxycodone is a legal, FDA-approved medication that has caused thousands of deaths. How did a properly tested pharmaceutical become a public health crisis? What went wrong in the toxicology assessment?
- Two patients take the same dose of the same medication. One feels better; the other ends up in the emergency room. What biological factors might explain this difference?
- St. John's Wort is a 'natural' supplement sold without prescription, yet it can make birth control pills ineffective and interact dangerously with antidepressants. Should herbal products be regulated like pharmaceuticals?

- Acetaminophen (Tylenol) is one of the leading causes of acute liver failure, yet it's available over-the-counter and considered safe. Is this a contradiction?
- Chemotherapy drugs are essentially poisons that kill rapidly dividing cells. How do oncologists decide how much poison is acceptable?
- Pregnant women are routinely excluded from clinical trials due to safety concerns, but they still get sick and need medications. How can we determine safe doses for pregnant women without testing on them?"
- Alcohol causes more deaths annually than many illegal drugs, damages multiple organ systems, and is addictive. If it were discovered today, would it pass FDA approval as a pharmaceutical? Why is it treated differently?
- Genetic testing can reveal that you metabolize certain drugs much faster or slower than average, meaning standard doses might be ineffective or toxic for you. Should genetic testing be required before prescribing high-risk medications?
- Trace amounts of medications (antibiotics, hormones, antidepressants) are found in drinking water from improper disposal and human excretion. The levels are far below therapeutic doses. Should we be concerned about chronic, low-level exposure to drug mixtures?
- During the COVID-19 pandemic, vaccines and treatments received emergency authorization with less long-term safety data than usual. How do we balance the need for speed with thorough toxicology assessment?
- Paracelsus said 'The dose makes the poison.' Vitamin A is essential for health, but excess causes liver damage, birth defects, and death. Should vitamins have the same warning labels as medications?"

Activity

- Case Study: Polyjuice Potion Gone Wrong" (Hermione's cat incident = allergic reaction)
  - Patient: Hermione Jean Granger
  - Age: 12 years
  - Date of Incident: December 1992
  - Location: Second-floor girls' lavatory, Hogwarts School
  - Substance Involved: Polyjuice Potion (improperly prepared)
  - What Happened: Hermione Granger attempted to use Polyjuice Potion to assume the identity of Millicent Bulstrode, a Slytherin student. However, she unknowingly added cat hair (from Millicent's cat) instead of human hair to the potion. Upon consumption, rather than transforming into Millicent Bulstrode, Hermione underwent a partial human-feline transformation, developing:
    - Cat-like facial features (whiskers, elongated nose, pointed ears)
    - Fur covering significant portions of her body
    - Cat eyes with slit pupils
    - A tail
  - The transformation did not reverse after the standard one-hour duration and required several weeks of treatment in the Hogwarts Hospital Wing with specialized magical antidotes.
  - The Allergic Reaction Parallel. While Polyjuice Potion is fictional, Hermione's adverse reaction mirrors key aspects of severe allergic responses in several compelling ways:

1. Inappropriate Immune/Biological Response In Allergic Reactions:
    - The immune system misidentifies harmless substances (allergens) as threats
    - Triggers an exaggerated defensive response (histamine release, inflammation)
    - The response itself causes more harm than the original substance

In Hermione's Case:

- Her body received genetic/biological information from the wrong species
- The Polyjuice Potion's transformative magic "misidentified" the target form
- Instead of rejecting the transformation, her body attempted to process incompatible biological data
- The resulting transformation was incomplete and pathological rather than functional

2. Dose-Response Relationship in Allergic Reactions:
    - Even minute quantities of allergen can trigger severe responses
    - Prior sensitization is not always necessary for first-time reactions

In Hermione's Case:

- A single hair (minimal biological material) was sufficient to trigger the reaction
- This was her first time using Polyjuice Potion, yet the response was immediate and severe
- The "dose" of foreign DNA/biological information was tiny but consequential

3. Cascade Effect In Allergic Reactions:
    - Initial exposure triggers a cascade of biological responses
    - Multiple body systems become involved (respiratory, cardiovascular, dermatological)
    - Effects compound rather than remaining localized

In Hermione's Case:

- The transformation affected multiple body systems simultaneously
- Changes were not isolated but systemic (facial features, skin, appendages)
- The magical cascade continued beyond normal parameters

4. Prolonged Recovery Period In Allergic Reactions:
    - Severe reactions (anaphylaxis) require extended medical intervention
    - Effects persist even after allergen removal
    - Body requires time to clear inflammatory mediators and repair damage

In Hermione's Case:

- Effects persisted for weeks despite immediate medical attention
- Simple reversal was impossible; required gradual correction with specialized treatments
- Body needed time to "reset" its biological parameters

- Discussion
    - How does Hermione's reaction to the cat hair illustrate the concept of an "inappropriate immune response"? Can you think of a real-life allergy (e.g., peanuts

or bee stings) that shows a similar mismatch between the trigger and the body's reaction? What might happen if the immune system didn't overreact in these cases?

- The case mentions that a single hair was enough to cause a severe transformation. Discuss how this relates to dose-response in allergies. Why do you think small amounts of allergens can lead to big problems? Share any personal experiences or stories about mild vs. severe allergic reactions.
- In the cascade effect, multiple body systems were affected. If this were a real allergic reaction, which systems (e.g., skin, eyes, respiratory) might be involved, and why?
- Why do you think the effects lasted weeks instead of reversing quickly? Compare this to anaphylaxis treatment (e.g., epinephrine). If Polyjuice Potion were real, what modern medical interventions (like antihistamines or gene therapy) might help "reset" the body?
- Hermione brewed and used the potion without supervision. Discuss the risks of self-experimentation in science or medicine. How does this relate to real-world issues like DIY biology (CRISPR use to alter embryo) or unauthorized drug use?
- The Polyjuice Potion involves "transformative magic," but it's compared to DNA or biological data. How might advancements in CRISPR or genetic editing make something like this possible in the future? What dangers could arise from mixing human and animal genetics?

Quiz

Exit Ticket – A 70-year-old patient with kidney disease is prescribed the same medication as a healthy 25-year-old. Should they receive the same dose? Explain using at least 2 toxicology principles.

Week 15: Antidotes & Treatment – "Defense against the Dark Arts"

Objectives

- Explain principles of antidote therapy
- Describe general supportive care measures
- Understand the concept of chelation therapy
- Identify the major classes of toxins and poisons that have specific antidotes available (e.g., opioids, benzodiazepines, organophosphates, heavy metals, acetaminophen)
- Describe the mechanisms of action for common antidotes and how they counteract specific toxins
- Evaluate risk-benefit ratios when considering antidote administration in cases with incomplete information
- Apply knowledge of antidotes to case-based scenarios involving common and uncommon poisonings

INDIVIDUAL LEARNING (PRIOR TO IN-PERSON MEETING)

 **Read**

- Kobylarz D, Noga M, et. al. *Antidotes in Clinical Toxicology-Critical Review*. Toxics. 2023 Aug 23;11(9):723.
- Wood DM, Dear JW, et. al. *Antidotes in the management of poisoned patients: What have we gained over the last decade?* Br J Clin Pharmacol. 2025 Mar;91(3):593-594.

 **Watch**

- Antidotes and Treatment of Toxicity (Order of the Phoenix)

 **Do**

- Consider:
  - A child accidentally swallows household bleach
  - A hiker is bitten by a venomous snake
  - A patient overdoses on opioids
- Discuss:
  - What immediate steps should be taken?
  - What kind of treatment might exist?
  - Why is timing important?
- What made these situations challenging?
- What information do you wish you had?
- Why might specialized treatments or antidotes be necessary?

 **Think**

- You're a healer at St. Mungo's Hospital. A patient arrives after drinking an unknown potion. What do you do?

IN-CLASS LEARNING/ACTIVITIES

 **Watch** clip: Video clips from St. Mungo's scene

 **Discuss**

- How do different antidotes work at the molecular level? Compare mechanisms like chelation (heavy metal poisoning), receptor antagonism (opioid overdose), and enzyme reactivation (organophosphate poisoning).
- Why are some antidotes highly specific while others are more broad-spectrum? What makes an ideal antidote?

- When should gastric decontamination be used versus focusing solely on antidote administration? How has thinking on this evolved?
- How do clinicians balance the risks of antidote side effects against potential benefits, especially when the diagnosis is uncertain?
- Should hospitals stock expensive antidotes for rare poisonings? How do institutions make these cost-benefit decisions?
- What happens in rural or resource-limited settings where specialized antidotes aren't readily available?
- Which poisonings have the narrowest therapeutic windows for antidote administration? What are the implications for emergency response systems?
- Should people who intentionally overdose receive the same priority for expensive antidotes as accidental poisonings?
- What are the implications of widespread naloxone distribution for opioid overdoses?
- Is activated charcoal overused or underused in modern toxicology?
- Compare treatment approaches for acetaminophen versus aspirin overdose
- Discuss managing mixed ingestions where multiple toxins complicate antidote selection

 **Activity**

- **Antidote Challenge (Healer Teams)**
- Scenarios:
  - Scenario 1: Child ate Death Cap mushrooms (real toxin)
    - Treatment: Silibinin, N-acetylcysteine, supportive care
  - Scenario 2: Wizard bitten by a Basilisk
    - Treatment: Antivenom, wound care, monitor for allergic reaction
  - Scenario 3: Accidental overdose of Sleeping Draught
    - Treatment: No specific antidote, supportive care, keep airway open
- Choose appropriate antidote or treatment
- Explain mechanism of how it works
- Describe expected outcome
- Identify potential complications

 **Quiz**

 **Exit Ticket –** Why do you think not every poison has an antidote, and what does that mean for treatment?

 **Assignment #5 Role Playing and Reflection**

Students step into a professional role, analyze a complex real-world or fictional scenario, and reflect on how their learning journey has prepared them to address similar challenges in the future.

PHR 2934 Course Project: Multimodal Investigation of Toxicological Impacts in Lived Environments

Objective

This project encourages application of toxicology to real-world challenges, fostering a deeper understanding of how toxins shape our lived environments.

Overview

Students will create a multimodal presentation that investigates a specific toxicological issue within a lived environment of their choice. This project builds on foundational concepts covered earlier in the course by requiring students to apply toxicological principles to real-world contexts at an advanced level. Students will select an environment (e.g., urban built spaces, agricultural fields, natural ecosystems, pharmaceutical industry, or cultural settings) and analyze how toxins interact with human life, drawing on interdisciplinary insights, personal experiences, and/or diverse perspectives. This project emphasizes creative and diverse ways to communicate complex ideas, incorporating visual, audio, digital, or performative elements.

How the course project addresses the GE Goals:

Goal	Course project component
Inspect lived environments at a more advanced and in-depth level than in the Foundations component	Students will use advanced toxicological analysis (scientific literature, sources, pathways, mechanisms, exposure scenarios, risk assessments) and incorporate multimodal elements like data visualizations, maps, or animated diagrams to show toxin fate and transport from environment to humans in their presentation
Integrate approaches to understanding lived environments by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work done in previous classes and anticipated in future	Students will connect their analysis to broader contexts in one or more of the following ways: 1. Link to out-of-classroom experiences (e.g., personal observations from their hometown, travel, or work in related fields like healthcare or agriculture) 2. Integrate academic knowledge from this course with other disciplines (e.g., sociology for social inequities in exposure, economics for cost-benefit analyses of remediation, or biology for ecological impacts) 3. Reflect on prior coursework (e.g., chemistry labs on chemical reactions) and future

	applications (e.g., how this informs career goals in environmental policy or public health)
Explore a range of perspectives on the interactions and impacts between humans and one or more types of environment (e.g., agricultural, built, cultural, economic, intellectual, natural) in which humans live	Students will examine multiple viewpoints on how humans interact with and are impacted by the toxicological issue in their chosen environment including: 1. Consider stakeholders such as affected communities, industry representatives, scientists, policymakers, and activists 2. Discuss interactions across environment types (e.g., how economic pressures in built environments lead to natural ecosystem degradation via toxin release) 3. Use case studies or examples to illustrate positive/negative impacts, such as health outcomes, biodiversity loss, or economic benefits/trade-offs
Analyze a variety of perceptions, representations, and/or discourses about environments and humans within them	Students will critically evaluate how their chosen toxicological issue is perceived and represented through: 1. Analysis of media representations (e.g., news articles, documentaries, or social media discourses on events like Flint water crisis) 2. Examination of cultural or intellectual discourses (e.g., indigenous knowledge on land stewardship vs. industrial narratives on "acceptable risk") 3. Discussion of biases, myths, or evolving perceptions (e.g., historical shifts in views on DDT from "miracle pesticide" to banned toxin)

GE Theme course submission worksheet: Lived Environments

Overview

Courses in the GE Themes aim to provide students with opportunities to explore big picture ideas and problems within the specific practice and expertise of a discipline or department. Although many Theme courses serve within disciplinary majors or minors, by requesting inclusion in the General Education, programs are committing to the incorporation of the goals of the focal theme and the success and participation of students from outside of their program.

Each category of the GE has specific learning goals and Expected Learning Outcomes (ELOs) that connect to the big picture goals of the program. ELOs describe the knowledge or skills students should have by the end of the course. Courses in the GE Themes must meet the ELOs common for **all** GE Themes and those specific to the Theme, in addition to any ELOs the instructor has developed specific to that course. All courses in the GE must indicate that they are part of the GE and include the Goals and ELOs of their GE category on their syllabus.

The prompts in this form elicit information about how this course meets the expectations of the GE Themes. The form will be reviewed by a group of content experts (the Theme Advisory) and by a group of curriculum experts (the Theme Panel), with the latter having responsibility for the ELOs and Goals common to all themes (those things that make a course appropriate for the GE Themes) and the former having responsibility for the ELOs and Goals specific to the topic of **this** Theme.

Briefly describe how this course connects to or exemplifies the concept of this Theme (Lived Environments)

In a sentence or two, explain how this class "fits' within the focal Theme. This will help reviewers understand the intended frame of reference for the course-specific activities described below.

(enter text here)

This course fits the Lived Environments theme by examining the interactions between humans and their biological environments, specifically how toxic substances enter, affect, and damage living systems. This course will also explore diverse scientific, cultural, and fictional perspectives on these human-environment relationships, including perceptions of poisons, antidotes, and risk in everyday and extraordinary contexts. This course advances students' exploration of these lived biological spaces through interdisciplinary integration in toxicology and with thought-provoking representations from a magical universe. Integrating a Lived Environments theme into a toxicology course shifts the focus form purely molecular mechanisms to real-world contexts where humans encounter chemicals, bridging the gap between hard science and social experience.

Connect this course to the Goals and ELOs shared by *all* Themes

Below are the Goals and ELOs common to all Themes. In the accompanying table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The specifics of the activities matter—listing "readings" without a reference to the topic of those readings will not allow the reviewers to understand how the ELO will be met. However, the panel evaluating the fit of the course to the Theme will review this form in conjunction with the syllabus, so if readings, lecture/discussion topics, or other specifics are provided on the syllabus, it is not necessary to reiterate them within this form. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

Goal 1: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations. In this context, "advanced" refers to courses that are e.g., synthetic, rely on research or cutting-edge findings, or deeply engage with the subject matter, among other possibilities.

Goal 2: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

	Course activities and assignments to meet these ELOs
ELO 1.1 Engage in critical and logical thinking about the topic or idea of the theme.	This course will consist of pre-class preparation (readings, online lectures, 'think about it' questions, and activities), in-class engagement (discussions, group activities), and reflective closure (exit tickets) to help students think critically and logically about toxicology in the context of human-lived environments. The course will go beyond the basic concepts and will use real-world examples emphasizing conceptual understanding. Online lectures will give students a foundation to enable engagement and discussion. The lecture recordings will have embedded questions to ensure students are not only absorbing the material, but are also stimulated to think critically about the topic/theme. Readings will provide foundational knowledge and expose students to diverse perspectives or theories related to toxicology and help them connect ideas logically to course content delivered before and during class. Pre-class activities will prompt students to apply concepts from the readings and online lectures in a low-stakes environment, giving them time to contemplate and develop questions. This fosters logical thinking by requiring them to organize information, identify key patterns or relationships, and anticipate counterarguments. Critically, this will help students evaluate the relevance of ideas to the theme of lived environments, preparing them to think more deeply about the topic. The 'think about it' prompt acts as a cognitive 'hook', asking students to reflect on a specific aspect of the topic. It promotes critical thinking by encouraging self-questioning (e.g. "What assumptions am I making") and logical deduction (e.g. "If this is true, how does it impact my thinking/understanding"). Priming students to articulate initial thoughts sets the stage for refining ideas through evidence and reasoning during class, helping them engage more thoughtfully with the material. The in-class discussions are designed to delve into the "why" and "how" of the material, prompting deeper thought and curiosity. In-class activities, such as case studies or problem-solving exercises give students opportunity for hands-on application. They encourage critical analysis by having students dissect real-world or relatable fictional scenarios, synthesizing information from readings and discussions, ensuring students don't just memorize but actively construct knowledge through iterative thinking. The exit ticket requires students to summarize key insights, unresolved questions, or personal connections to the material. This reinforces critical thinking by prompting self-evaluation (e.g. "What changed my view") and logical synthesis (e.g. integrating class discussions into a coherent takeaway). Additionally, students will complete a course project which will incorporate the GE ELOs and course specific learning objectives which will help students synthesize their knowledge, demonstrate comprehensive understanding, and see how different concepts connect in practical application. Collectively, these components create a scaffolded learning experience that moves students from individual preparation to interactive application and reflection. The iterative process ensures ongoing engagement cultivating habits of inquiry, evidence-based reasoning, and adaptive thinking. Relevant assignments: Assignment #1 (Toxicokinetic Detective), Course Project (see included document detailing how this project relates to the GE ELOs) See included Course Map for more detail.
ELO 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme.	Students will think about how specific toxins affect their lives and their environments where they live, work, and play through analyzing peer review studies, examining case studies, and critically exploring the complex interplay between toxin exposure and public health outcomes in real-world settings. Additionally, incorporating carefully crafted fictional scenarios (magic/potions theme) increases interest and engagement and allows students to apply theoretical knowledge to complex, realistic situations in a low stakes environment that mirror the multifaceted nature of real world toxicological challenges. Relevant assignments/activities: Course Project, Case studies Relevant readings: -Shetty SS, Deepthi D, et. al.. Environmental pollutants and their effects on human health. Heliyon. 2023 Aug 25;9(9):e19496, provides scientific evidence on how environmental pollutants impact human health in everyday settings like homes, workplaces, and communities -Larsson, D.G.J., and Flach, CF. Antibiotic resistance in the environment. Nat Rev Microbiol 20, 257–269 (2022), examines how community members learn about chemicals in their bodies and everyday environments, showing that technical content and lived experience are intertwined as well as how toxicology education can integrate out-of-classroom experiences with academic knowledge across multiple disciplines

ELO 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme.	The course structure promotes advanced scholarly exploration through a layered progression from individual preparation to collaborative inquiry. Readings expose students to specialized arguments and data that require analytical depth. Pre-class activities push beyond comprehension into synthesis and critical analysis, while the 'think about it' questions prime students for higher-level inquiry by prompting them to consider implications, contradictions, and broader connections. In-class discussions move from "what" to "so what", engaging students in rigorous evidence evaluation and interdisciplinary debate that mirrors academic discourse. Hands-on group activities simulate scholarly processes like analyzing data, constructing arguments, and critiquing theoretical limitations. Finally, exit tickets prompt meta-cognitive reflection, helping students articulate emerging insights and unresolved questions while developing their scholarly voice. A final integrated course project will encourage students to connect their knowledge to out-of-classroom experiences and/or to previous anecdotal or class experience knowledge. Relevant activity: Case study example: Students select a real-world toxicological issue (e.g industrial pollution, agricultural pesticide use, urban lead contamination, electronic waste etc.) and analyze the issue through multiple lenses: 1) biological/chemical mechanisms of toxicity, 2) epidemiological data and public health impacts, 3) socioeconomic factors and environmental justice dimensions, 4) policy and regulatory frameworks, 5) community perspectives Relevant assignment: Course Project Relevant reading: Adams C, Brown P, et. al. Disentangling the exposure experience: the roles of community context and report-back of environmental exposure data. J Health Soc Behav. 2011 Jun;52(2):180-96, examines how community members learn about chemicals in their bodies and everyday environments, showing that technical content and lived experience are intertwined as well as how toxicology education can integrate out-of-classroom experiences with academic knowledge across multiple disciplines. See included Course Map for more detail.
ELO 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.	Students will integrate course content with and critically think about personal exposure and activities in their "lived spaces" (campus, neighborhood, park etc.). Students will draw parallels to out-of-class experiences such as family health issues related to pollution, adverse effects of pharmaceuticals etc., and reflect on how this knowledge might apply to future careers or to public health in general. Relevant assignments: Assignment #5 (Role playing and reflection) involves a role playing scenario where students assume a professional role (e.g. urban planner, education administrator, public health official etc.) and analyze a real world or fictional setting and write a forward-looking essay on how the activity built on past learning and prepared them for future challenges related to these issues.; Course Project, Think about it exercises, Exit tickets

Example responses for proposals within "Citizenship" (from Sociology 3200, Comm 2850, French 2803):

***ELO 1.1** Engage in critical and logical thinking.*	*This course will build skills needed to engage in critical and logical thinking about immigration and immigration related policy through:* *Weekly reading response papers which require the students to synthesize and critically evaluate cutting-edge scholarship on immigration;* *Engagement in class-based discussion and debates on immigration-related topics using evidence-based logical reasoning to evaluate policy positions;* *Completion of an assignment which build skills in analyzing empirical data on immigration (Assignment #1)*

	Completion 3 assignments which build skills in connecting individual experiences with broader population-based patterns (Assignments #1, #2, #3) *Completion of 3 quizzes in which students demonstrate comprehension of the course readings and materials.*

ELO 2.1 *Identify, describe, and synthesize approaches or experiences.*	*Students engage in advanced exploration of each module topic through a combination of lectures, readings, and discussions.* *<u>Lecture</u>* *Course materials come from a variety of sources to help students engage in the relationship between media and citizenship at an advanced level. Each of the 12 modules has 3-4 lectures that contain information from both peer-reviewed and popular sources. Additionally, each module has at least one guest lecture from an expert in that topic to increase students' access to people with expertise in a variety of areas.* *<u>Reading</u>* *The textbook for this course provides background information on each topic and corresponds to the lectures. Students also take some control over their own learning by choosing at least one peer-reviewed article and at least one newspaper article from outside the class materials to read and include in their weekly discussion posts.* *<u>Discussions</u>* *Students do weekly discussions and are given flexibility in their topic choices in order to allow them to take some control over their education. They are also asked to provide* *information from sources they've found outside the lecture materials. In this way, they are able to* *explore areas of particular interest to them and practice the skills they will need to gather information* *about current events, analyze this information, and communicate it with others.* *Activity Example: Civility impacts citizenship behaviors in many ways. Students are asked to choose a TED talk from a provided list (or choose another speech of their interest) and summarize and evaluate what it says about the relationship between civility and citizenship. Examples of Ted Talks on the list include Steven Petrow on the difference between being polite and being civil, Chimamanda Ngozi Adichie's talk on how a single story can perpetuate stereotypes, and Claire Wardle's talk on how diversity can enhance citizenship.*
ELO 2.2 *Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.*	*Students will conduct research on a specific event or site in Paris not already discussed in depth in class. Students will submit a 300-word abstract of their topic and a bibliography of at least five reputable academic and mainstream sources. At the end of the semester they will submit a 5-page research paper and present their findings in a 10-minute oral and visual presentation in a small-group setting in Zoom.* *Some examples of events and sites:* *The Paris Commune, an 1871 socialist uprising violently squelched by conservative forces*
	Jazz-Age Montmartre, where a small community of African-Americans–including actress and singer Josephine Baker, who was just inducted into the French Pantheon–settled and worked after World War I. *The Vélodrome d'hiver Roundup, 16-17 July 1942, when 13,000 Jews were rounded up by Paris police before being sent to concentration camps* *The Marais, a vibrant Paris neighborhood inhabited over the centuries by aristocrats, then Jews, then the LGBTQ+ community, among other groups.*

Goals and ELOs unique to Lived Environments

Below are the Goals and ELOs specific to this Theme. As above, in the accompanying Table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

GOAL 3: Successful students will explore a range of perspectives on the interactions and impacts between humans and one or more types of environment (e.g. agricultural, built, cultural, economic, intellectual, natural) in which humans live.

GOAL 4: Successful students will analyze a variety of perceptions, representations and/or discourses about environments and humans within them.

	Course activities and assignments to meet these ELOs
ELO 3.1 Engage with the complexity and uncertainty of human-environment interactions.	Students will work on case studies with genuine uncertainty such as air pollution, PFAS contamination, or endocrine disruptors where the science is still evolving. These exercises will show that toxicology is not just knowing dangerous levels, but navigating incomplete information. Additionally activities will explore the complexity of chemical and human relationships such as why the same chemical may be safe for one population but harmful to another, or why timing or route of exposure matters. Other activities will address the gap between laboratory and real-world conditions and discuss why animal studies don't always predict human effects or why epidemiological studies can yield conflicting results. Relevant assignments: Assignment #2 (The complexity of chemical safety and risk assessment) will have students explore why chemical safety isn't one-size-fits-all and why scientific studies sometimes seem to contradict each other. Students will investigate how the same substance can be safe for some people but harmful to others, and why translating laboratory findings to real-world human health is so challenging.; Course Project, Case studies Relevant reading: Mansfield, B., Werner, M., Berndt, C. et al. A new critical social science research agenda on pesticides. Agric Hum Values 41, 395–412 (2024), argues that pesticides transform social and environmental relationships in complex ways that cannot be replicated in a laboratory or conveyed by ingredients and toxicological outcomes.
ELO 3.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space.	Through class activities and case studies, students will explore how human activities introduce toxic substances into environments and examine the resulting ecological and health consequences across different scales. From a historical perspective students will trace how industrialization, agricultural, pharmaceutical, and consumer product development have altered chemical exposures over time (e.g. lead in Roman times to present day PFAS contamination). Students will also examine the spatial dimensions where toxicants move through air, water, and soil across local to global scales. Additionally, students will study human-environment interactions such as pesticide use affecting pollinators and food systems, pharmaceutical waste altering aquatic ecosystems, or air pollution from fossil fuel combustion illustrating how human chemical use transforms living environments. Relevant assignments: Assignment #4 (Tracking toxicants: A multiscale investigation activity) will involve constructing a historical timeline and pathway mapping that will have students investigate how a specific toxic substance moves through environmental systems and impacts ecological and human health across time and space., Case studies Relevant reading: Nogué, S., Morueta-Holme, N., et al. Human transformation of past terrestrial ecosystems. Nat. Rev. Biodivers. 1, 644–656 (2025), examines how humans have been modifying ecosystems for millennia.
ELO 4.1 Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values, and behaviors.	Through case studies, students will examine how exposure to environmental toxins and awareness of chemical hazards have influenced society by exploring how toxicological disasters and discoveries fundamentally shifted public awareness and sparked environmental movements which have affected cultural values around chemical safety and corporate responsibility. Students will also analyze how knowledge of toxins influence daily choices (consumer preferences or residential decisions) revealing how scientific understanding of environmental hazards shapes behavior patters and market demands. Students will also examine case studies around health equity and values showing how differential exposure to toxins has shaped activism, civil rights frameworks, and beliefs about fairness and bodily autonomy. Additionally, students will explore emerging concerns (such as endocrine disruptors or microplastics) and how they are reshaping contemporary attitudes about consumption, waste, and technological progress across generations. Relevant assignments: Course Project, Case studies Relevant reading: -Stahlmann R, Horvath A. Risks, risk assessment and risk competence in toxicology. Ger Med Sci. 2015 Jul 9;13, discusses how laypeople hardly differentiate between levels of toxicity and often disregard dose-effect relationships, believing that mere contact with a toxic substance is a health risk, and how most laypeople consider natural substances less dangerous than synthetic compounds

ELO 4.2 Describe how humans perceive and represent the environments with which they interact.	Students will examine how humans conceptualize and communicate about toxic environments and chemical hazards. Case studies will challenge students to consider how humans represent hazards that are often invisible, odorless, and imperceptible. Working with data such as risk maps and dose response curves will help make abstract chemical exposures concrete and understandable. Students will also analyze how different communities perceive and describe toxic environments through varied lenses, how scientific terminology differs from lived experience narratives, how Indigenous knowledge systems about land health versus Western toxicological models shapes perceptions, and how metaphors of "clean" versus "contaminated" spaces carry moral and social meanings. Additionally, class activities will explore and discuss terminology that reveals how scientific language frames human relationships with toxic environments and influences perception of safety vs danger. Other case studies will highlight how different stakeholders (e.g. industry, regulators, affected communities, scientists) produce competing representations of the same toxic environment, revealing how perception is shaped by values, interests, and methods of inquiry. This approach helps students recognize that toxicological knowledge involves not just chemical facts but interpretive frameworks for understanding human-environment relationships. Relevant Assignments - Assignment #3 (Making the invisible visible) explores how scientists, public health officials, and communities make abstract chemical exposures concrete and understandable through data visualization and risk communication.; Course Project, Case studies
ELO 4.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.	Students will critically examine the frameworks, assumptions, and power structures that shape how toxic exposures and environmental contamination are discussed and managed. Through case studies, students will analyze the underlying conventions of toxicology such as the "dose makes the poison" principle, threshold models, or acceptable daily intake calculations, questioning whose values determine what constitutes "acceptable" risk. Students will also deconstruct popular distinctions between natural and artificial chemicals, examining how these categories shape public perception and policy despite toxicological principles showing both can be harmful, revealing cultural biases embedded in environmental discourse. Case studies will also enable students to examine debates around emerging contaminants (e.g. PFAS, microplastics, endocrine disruptors) which reveal ideological assumptions about whether chemicals should be proven harmful before restriction or proven safe before use, and who bears health risks during uncertainty. Relevant assignments: Course Project, Case studies