

USC Mann

Alfred E. Mann School of Pharmacy
and Pharmaceutical Sciences

Fall 2024

RXRS 304-Mysterious Deaths: From Poisons in History to Forensic Toxicology *6-24-2024-RCI*

Instructors:

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Course Weight: 4 Units

Days/Time/Location: Wednesday's 3:00 pm to 5:50 pm, location KAP 163

Course catalogue description: The story of poisons told through the prism of history, as a way to discover forensic toxicology.

Introduction

The use of poisons is weaved into human history, from the natural substances that humans learned to use for healing and criminal purposes, to the man-made chemicals of the 20th century inducing sickness or death, including those designed to improve life, and those purposely created for biological or chemical warfare. Poisons have fascinated and inspired people, occupying a prominent place in historical and fictional stories. Sadly, the topic of poisons has not faded in time, as we are regularly reminded through the recounting of recent poisoning events, accidental or deliberate, by the media. This course will take advantage of this rich but sometimes unsettling heritage to introduce students to major classes of poisons and to the basic concepts of forensic toxicology, balancing them against the beneficial (medicinal), and industrial uses of many of these substances.

The goal of the course is to make students aware of the pertinence of toxicology in our daily life, to teach them the basic tools allowing them to assess the risks and benefits of chemical exposures and to trigger their curiosity for learning more about toxicology.

Objectives

The course is designed for undergraduates of both scientific and non-scientific majors with an interest in understanding how the knowledge of poisons led to the development of toxicology. This will be done through an overview of major poisons, their traditional and medicinal uses, and industrial purposes, and how the understanding of their toxicity evolved over time.

We will discuss the emergence of forensic toxicology in USA following the intentional poisoning of American citizens by the government during the Prohibition in the 1920s-1930s; and many more puzzling mysteries that have inspired writers such as Agatha Christie.

Chapters from the required textbook will be supplemented with a variety of source materials, including documentaries, media articles and book chapters. Emerging “hot” topics in poisoning incidents will be discussed, and students will get the opportunity to discuss the poisons of their choice through short presentations with their peers.

Upon successful completion of this course a student should be able to:

- Discuss how poisons have influenced human history.
- Explain the origins, main principles, and concepts of toxicology.
- Understand the analytical methods used in forensic toxicology.
- Describe the major toxicity mechanisms of poisons.
- Generate a comprehensive and compelling presentation of a poison.

Assignments and Grading:

Class participation:	16 pts (6.4%)
Short reflection essays (1 point each max):	14 pts (5.6%)
2 quizzes @ 10 pts each:	20 pts (8%)
3 short presentations on a poison @ 10 pts each	30 pts (12%)
2 midterm exams @ 35 pts each:	70 pts (28%)
1 written report due on the day of the exam	50 pts (20%)
<u>1 final exam (partially cumulative):</u>	<u>50 pts (20%)</u>
Total:	250 pts – 100%

Class Participation and Attendance (16 pts):

Participation includes asking and answering questions and being actively involved in the discussion. Students are encouraged to express freely their opinions on the topics that are discussed, being ready to articulate their reasoning in a collegial and constructive manner that incites discussion; taking into consideration all sides of a story with an open mind, given them tools to reassess dogma or preconceived ideas if applicable.

Attendance in person at all classes is expected. Students are expected to read the assigned papers prior to the lecture and be prepared to discuss the background, current understanding, and gaps in knowledge for the topic in each lecture. Zoom access may be available, but limited to health issues to be reported to the course director before class.

Short reflection essays (max 1 point/essay): Students are expected to write short “reflection” essays on classes (~ 1 page/class), explaining what they learned from the lecture, their thoughts about the relevance of the topic and any suggestion they have. This activity can lead to a maximum of 14 points (1 point/essay), representing a max of 5.6% of the total grade. See posted Guidelines for details.

Quizzes (10 points each) include 10 questions (multiple choice questions, T/F questions, fill-in the blank questions). Each quiz covers several lectures, which are indicated in the schedule.

Short presentations (10 points each) consist of oral presentations (~ 5 slides) by students (individual and/or teams) on the poison of their choice. Topic selection needs to be made at least one week in advance and approved by instructor. Instructor will share it with other students to avoid duplication. Topic approval is on first come-first served basis.

Midterms (35 points each) will include multiple choice questions, and T/F questions and fill-in the blank or short answer questions. Each exam covers several lectures which are indicated in the schedule.

Final exam (50 points) will have a similar format as the midterms. The final exam will be cumulative but will emphasize material covered after the 2nd midterm, as listed in schedule.

Written report (50 pts): The class deliverable is a 5 page write up, which can be based either on a chapter from “The Poisoner’s Handbook” by D Blum, one of the other recommended readings, class sources of information (videos, movies, chapter of recommended/suggested books such as Agatha Christie books) or based on a different topic, approved by the instructor. Short presentation topics can also be used, but the report needs to be individual, and should include more in depth contents than the short presentation slides (it cannot copy the content from the slides).

“No deliverable turned in” will be scored 0.

Students will be evaluated on the excellent synopsis, completeness, quality, clarity, and critical discussion of the selected source. See posted Guidelines for grading rubric and other details.

There are no make-up exams. If exceptional circumstances prevent you from attending an exam, your reason for missing it must be accompanied by a written statement from a third party (e.g. a note from a medical doctor). Notes, books, calculators, electronic dictionaries, regular dictionaries, cell phones or any other aids are not allowed during exams.

Required Text:

The Poisoner's Handbook: Murder and the Birth of Forensic Medicine in Jazz Age New York. By **Deborah Blum**

ISBN-13: 978-0143118824; ISBN-10: 014311882X

Available on Amazon for ~ \$9.00 - \$15.00

We will supplement the reading with segments from videos/movies on the poisons discussed in class.

Course Readings

Required Readings: selected, short, easy to read chapters from the following books:

John Emsley. *Molecules of Murder: Criminal and Classic Cases.* (2008) RCS Publishing, Thomas Graham House, Science Park, Milton Road, Cambridge CB4 0WF, UK

John Emsley. *The Elements of Murder: A History of Poisons.* (2005) Oxford University Press, Great Clarendon Street, OX2 6DP

Kathryn Harkup. *A is for Arsenic: The Poisons of Agatha Christie.* (2015) Bloomsbury Sigma, 1385 Broadway, New York, New York 10018.

Deborah Blum. *The Poison Squad: One Chemist's Single-Minded Crusade for Food Safety at the Turn of the Twentieth Century.* Penguin Press. ISBN-13: 978-1594205149; ISBN-10: 1594205140

Although not mandatory, it is strongly suggested that the students purchase these books, as it will provide a resource to reinforce and supplement the lectures, and support their learning process throughout the semester. Moreover, this material can be used as source for their written report.

Suggested articles to read or listen to:

Acocella, J. Murder by Poison. *The New Yorker*, October 14, 2013.

Alizadeh et al. Black henbane and its toxicity – a descriptive review. *Avicenna J of Phytomedicine*, 4:297-311, 2014.

Chidiac, EJ, et al. Mandragora: Anesthetic of the Ancients. *Anesth Analg* 115:1437-41, 2012.

Holzman, RS. The Legacy of Atropos, the Fate Who Cut the Thread of Life. 89:241-249, 1998.

Langman, LJ and BM Kapur. Toxicology: Then and Now, *Clinical Biochemistry* 39:498-510, 2006.

Pearce, DN. Sherlock Holmes, Conan Doyle and cocaine. *Journal of the History of Neurosciences* 3:227-232, 1994.

Rozman KK and J Doull. Paracelsus, Haber and Arndt. *Toxicology* 160:191-196, 2001.

Bardell, EB. Literary Reflections of Pharmacy XI: Thallium as "An Untraceable Poison". *Pharmacy in History* 30:188-190, 1988.

Dayon, AD. What killed Socrates? Toxicological considerations and questions. *Postgrad Med J* 85:34-37, 2009.

Hughes, MF et al. Arsenic Exposure and Toxicology: A Historical Perspective. *Toxicological Sciences* 123:3005-332, 2011.

Lee, MR. Solanaceae IV: Atropa belladonna, Deadly Nightshade. *J R Coll Physicians Edinb* 37:77-84, 2007.

Reynolds, T. Hemlock alkaloids from Socrates to poison aloe. *Phytochemistry* 66:1399-1406, 2005.

Murder by poison – the rise and fall of arsenic.

<https://www.newyorker.com/magazine/2013/10/14/murder-by-poison>

Other course materials, including but not limited to the syllabus, supplemental reading assignments and additional handouts will be posted on Brightspace. Students are encouraged to use the online discussions among students via Brightspace.

<https://brightspace.usc.edu/>

Course Evaluations

Course evaluation occurs at the end of the semester university wide. Students will be asked to complete an anonymous critical evaluation of the course at its completion. It is an important review of students' experience in the class.

Course Outline

This course will be in the format of lectures given by instructors on specific topics. During each weekly session, the instructor will engage students with questions and draw comments or interpretations primarily based on the assigned reading. Some classes will include student short presentations. Students are expected to ask questions and participate in an interactive fashion.

Course schedule is as follows:

Week & Date Fall 2024	Topic	Subtopics to be Included	Assigned and Supplemental Reading
Aug 28 (wk 1) MC	Introduction: expectations and goals of this class. Overview of toxicology vs pharmacology	<ul style="list-style-type: none"> Understand the basic principles of toxicology Hazard, risk and exposure Dose response 	http://www.toxmsdt.com/0-toxtutor-home.html
Sept 4 (wk 2) MEC	Milestones in Forensic Analysis of Poisons	<ul style="list-style-type: none"> Learn about the development of assays to measure poisons Understand how forensic toxicology has progressed over time 	<ul style="list-style-type: none"> Introductory Chapter, Emsley, 2008 Langman and Kapur, 2006 Norris & Gettler, NY Coroner's Office, 1918
Sept 11 (wk 3) MC	History of the Use of Poisons: Overview	<ul style="list-style-type: none"> Learn about famous poison victims Learn about poison use in politics Understand how chemicals can be used as both medicines and poisons 	Intro on 5 of the deadliest poisons: https://www.bbc.com/future/article/20161020-the-five-deadliest-poisons-known-to-humans
Sept 18 (wk 4) MC 1st short presentation	Ricin	<ul style="list-style-type: none"> Learn about the use of ricin in history, literature and political poisoning Understand how ricin works 	Chapter 1, Emsley, 2008 Chapter R, Harkup, 2015 The Umbrella Assassin https://www.youtube.com/watch?v=HsVRYhLLPCM At ~ 35 min in https://www.pbs.org/video/university-place-poisoners-guide-life/
Sept 25 (wk 5) MEC Quiz 1 (wk1-3)	Methanol and ethanol	<ul style="list-style-type: none"> Learn about the use of methanol in improper alcoholic drink production Understand how methanol and ethanol toxicities differ 	Methanol poisoning https://www.youtube.com/watch?v=PsVwJBSfBAY MeOH at ~ 32 min in video: https://www.pbs.org/video/university-

			place-poisoners-guide-life/
Oct 2 (wk 6) MEC	Arsenic toxicity; food as poison in the 1800-1900s and the birth of the FDA.	<ul style="list-style-type: none"> Learn how people were exposed to toxicants via food, and how Wiley and his team of chemists fought to ensure food quality in USA. Learn about the use of arsenic as a medicine, preservative, and poison through history and literature Learn about natural forms & industrial use of arsenic 	Chapters 2-4; 12-14, Emsley, 2005 Chapter A, Harkup, 2015. “The Poison Squad” book by Deborah Blum. Talk show by D. Blum Kinter Lecture Arsenic by D. Blum (~32 min): https://www.youtube.com/watch?v=elSqUjkMWFU
Oct 9 (wk 7) MC Midterm1 (wk1-5)	Carbon Monoxide	<ul style="list-style-type: none"> Understand the toxicity of carbon monoxide, and how it works Learn about the sources of carbon monoxide 	Chapter 7, Emsley, 2008 CO at ~ 20-30 min): https://video.mainepublic.org/video/university-place-poisoners-guide-life/
MIDTERM 1 - Oct 9 (online, covering weeks 1-5)			
Oct 16 (wk 8) MC	Environmental poisoning, Mercury, Lead, POPs, pesticides, phthalates	<ul style="list-style-type: none"> Learn about poisons you are exposed to from the environment Learn about the history and medicinal use of mercury and lead Understand the mechanisms of toxicity of mercury and lead Learn about historical toxic accidents that affected humans 	Chapters 2-4; 12-14, Emsley, 2005 One Man's Experience with Methyl Mercury Poisoning https://www.youtube.com/watch?feature=player_embedded&v=e2Nsy0c22R8 Website: http://www.environmentalhealthnews.org/ Reference Movie: a civil action
Oct 23 (wk 9) MC Quiz 2 (wk 6-8)	Cyanide: Nazi Regime, Tylenol, Jonestown Massacre and others	<ul style="list-style-type: none"> Understand the historical uses of cyanide Learn about natural cyanides Understand how cyanide works 	Chapter 8, Emsley, 2008 Chapter C, Harkup, 2015 Cyanides in Excedrin: https://www.youtube.com/watch?v=b0reHh7Sq9s
Oct 30 (wk 10) MC 2nd short presentations	Morphine and Morphine Like Compounds	<ul style="list-style-type: none"> Learn about the historical uses of opiates Review the use of opiates in literature Understand the medicinal uses and abuse-associated risks of opiates 	Chapter 4 Emsley, 2008 Chapter O, Harkup, 2015
Nov 6 (wk 11) MC Midterm2 (wk 6-9)	Poison Hemlock	<ul style="list-style-type: none"> Learn about the use of hemlock in history and literature Understand how hemlock works 	Chapter H, Harkup, 2015 Five Little Pigs; Agatha Christie (trailer)
MIDTERM 2 – Nov 6 (online, covering weeks 6-9)			
Nov 13 (wk 12) MEC	Polonium and Thallium	<ul style="list-style-type: none"> Learn about the use of polonium and thallium in history and literature Understand how polonium and thallium kill 	Chapter 10, Emsley, 2008 Chapter T, Harkup, 2015 The polonium plot https://www.youtube.com/watch?v=1FqcFaJEnh8 https://www.youtube.com/watch?v=z8tJzsFEq8M

Nov 20 (wk 13) MC & TC	Renaissance poisons: Belladonna, Henbane and Mandrake	<ul style="list-style-type: none"> • Learn about the historical and cultural uses of plant alkaloids • Understand the medicinal uses of materials derived from these plants Understand how they work	Chapter 2, 3, Emsley, 2008; Chapter B, Harkup, 2015 The use of sacred weeds https://www.youtube.com/watch?v=iQepGtmpUR4 https://www.youtube.com/watch?v=uLZiKBdMEIc
Nov 27	Thanksgiving Recess (Nov 27 to Dec 1, 2024)		
Dec 4 (wk 14) MC & HG 3rd Short presentations	Botulinum toxin and BOTOX	<ul style="list-style-type: none"> • Understand how botulinum toxins work • Learn about the history and the cosmetic and therapeutic uses of Botox 	
RXRS 304 Final Exam (wks 10-14 & previous): Monday, December 16, 2024 from 2 to 4 pm in KAP 163			

Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

Use of Artificial Intelligence

There is an expectation about AI (e.g., ChatGPT and image generation tools) use for this class. Learning to use AI is an emerging skill, and discussions about appropriate use are welcome. It is recommended that you take the opportunity to meet with your professor to get guidance with the use of these tools during office hours or after class. Keep in mind the following:

- AI tools are allowed to help you brainstorm topics or revise work you have already written.
- If you supply minimum-effort prompts, you will get low-quality results. You will need to refine your prompts to get good outcomes. This will take work.
- Proceed with caution when using AI tools and do not assume the information provided is accurate or trustworthy. If it gives you a number or fact, assume it is incorrect unless you either know the correct answer or can verify its accuracy with another source. You will be responsible for any errors or omissions provided by the tool. It works best for topics you understand.
- AI is a tool, but one that you need to acknowledge using. Please include a paragraph at the end of any assignment that uses AI explaining how (and why) you used AI and indicate / specify the prompts you used to obtain the results what prompts you used to get the results. Failure to do so is a violation of academic integrity policies.
- Be thoughtful about when AI is useful. Consider its appropriateness for each assignment or circumstance. The use of AI tools requires attribution. You are expected to clearly attribute any material generated by the tool used.

Academic Integrity

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the [USC Student Handbook](#). All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or “recycle” work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the [student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Statement on Academic Conduct and Support Systems

Academic Integrity:

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, compromises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or “recycle” work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see [the student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. [The Office of Student Accessibility Services](#) (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process

(registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

[Counseling and Mental Health](#) - (213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

[988 Suicide and Crisis Lifeline](#) - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

[Relationship and Sexual Violence Prevention Services \(RSVP\)](#) - (213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

[Office for Equity, Equal Opportunity, and Title IX \(EEO-TIX\)](#) - (213) 740-5086

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

[Reporting Incidents of Bias or Harassment](#) - (213) 740-5086 or (213) 821-8298

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

[The Office of Student Accessibility Services \(OSAS\)](#) - (213) 740-0776

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

[USC Campus Support and Intervention](#) - (213) 740-0411

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

[Diversity, Equity and Inclusion](#) - (213) 740-2101

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

[USC Emergency](#) - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#) - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call

Non-emergency assistance or information.

[Office of the Ombuds](#) - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - (323) 442-2850 or otfp@med.usc.edu

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.