

USC School of Pharmacy

Fall 2021

RXRS 304: Mysterious Deaths: From Poisons in Literature and History to Forensic Toxicology

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Course Weight: 4 Units

Days/Time/Location: Wednesday 3:30 pm - 6:20 pm* (THH110). (*the last 30 min of class can be spent working on home-assignment)

Course catalogue description: The story of poisons and their deliberate use told through the prism of history and literature, as way to discover forensic toxicology.

Introduction

The use of poisons is weaved into human history, from the natural substances humans learned to use for healing and criminal purposes, to the man-made chemicals of the 20th century designed to improve life that inadvertently induced sickness or death, to those purposely designed 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) use of some of these substances. The goal of the course is to expose students to a serious topic in a manner that triggers their curiosity for learning more about toxicology in more advanced courses.

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 use in cultural traditions and beliefs, but also for medicinal and industrial purposes all around the world; the intentional poisoning of American citizens by the government during the Prohibition in the 1920s-1930s, leading to the emergence of forensic toxicology in USA; 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. Selected cases studies will be reviewed and emerging “hot” topics in poisoning incidents discussed.

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

- Discuss how poisons have influenced history and literature
- Explain the major reasons behind the danger of classical and novel poisons
- Describe the origins and basic principles of forensic toxicology
- Generate a comprehensive and compelling presentation on a poison

Assignments and Grading:

Class participation:	20 pts (8%)
3 quizzes @ 10 pts each	30 pts (12%)
2 short presentations on a poison @ 10 pts each	20 pts (8%)
2 midterm exams @ 35 pts each:	70 pts (28%)
1 written report due on the day of the exam	50 pts (20%)
1 final exam (partially cumulative):	<u>60 pts (24%)</u>
Total:	250 pts

Class Participation and Attendance (20 pts): Participation includes asking and answering questions and being actively involved in the discussion. Attendance 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.

30 min home-assignment: Students are expected to spend 30 min at home to write a short “reflection” essay on the class (1 page), 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 7 bonus points** (2.8% of the total) by the end of the course.

Written report (50 pts): The class deliverable will be a 5 page write up on one of the chapters of the required text “**The Poisoner's Handbook**” by **D Blum**, or one of the other recommended readings and class sources of information, based on a toxin or poison of choice. While “No deliverable turned in” will be scored 0, the highest score will be given to an excellent synopsis of the extracurricular source of information. It is expected that the students will engage one of the extracurricular sources of information (based on one of the cited videos, the reading of one of the recommended or suggested sources, or reading of one of the reviewed pieces of literature [e.g. a book by Agatha Christie]) of a subject of interest.

Quizzes (10 points each) include 10 questions (multiple choice questions, T/F questions, fill-in the blank questions).

Short presentations (10 points each) consist of oral presentations (~ 5 slides) by students on a poison of their choice.

Midterms (35 points each) will include multiple choice questions, and T/F questions and fill-in the blank or short answer questions.

Final exam (60 points) will have a similar format as the midterms. The final exam will be cumulative but will emphasize material covered after the 2nd midterm.

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.

Students will be asked to complete an anonymous critical evaluation of the course at its completion.

Required Text:

The Poisoner's Handbook: Murder and the Birth of Forensic Medicine in Jazz Age New York

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)

- 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 for this course, as it will provide a resource to reinforce and supplement the lectures on the use of poisons throughout literature and history. The students will be able to use identified chapters in the text to support their learning process throughout the semester.

Suggested articles to read:

- 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 aloes. *Phytochemistry* 66:1399-1406, 2005.

Other course materials including but not limited to the syllabus, supplemental reading assignments and additional handouts will be posted on <http://blackboard.usc.edu/>. Students are encouraged to use the online discussions among students via Blackboard.

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 the students with questions and draw comments or interpretations primarily based on the assigned reading. Students are expected to ask questions and participate in an interactive fashion.

Course schedule is as follows:

Week & Date Fall 2021	Topic	Subtopics to be Included	Assigned and Supplemental Reading
Introduction and Background			
August 25 (wk 1) DD	Introduction: expectations and goals of this class. General overview of toxicology	<ul style="list-style-type: none"> Understand the basic principles of toxicology - Hazard, risk and exposure - Dose response 	Website for those who want to know more about toxicology: http://www.toxmsdt.com/0-toxtutor-home.html
Sep 1 (wk 2) 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 	http://www.toxmsdt.com/0-toxtutor-home.html
Sep 8 MEC (wk 3) Quiz 1	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 https://www.youtube.com/watch?v=rEPzykzciPc https://www.dailymotion.com/video/x70grhn
Sep 15 (wk 4) 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: https://www.youtube.com/watch?v=ouJRlqCibMw Kinter Lecture Arsenic by D. Blum: https://www.youtube.com/watch?v=eISqUjkmWfU
Sep 22 MIDTERM 1 - Sep 22 (first hour, covering weeks 1-4)			
Sep 22 MC (wk 5) (Midterm1)	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=TZi3lUmN7FE
Sept 29 MC (wk 6)	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 6 MC (wk 7) Quiz 2	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 Opioid Nation: The Making of an Epidemic: https://www.youtube.com/watch?v=ygqalPOT3Tw
Oct 13 MC (wk 8)	Ricin	<ul style="list-style-type: none"> Learn about the use of ricin in history, literature and political poisonings Understand how ricin works 	Chapter 1, Emsley, 2008 Chapter R, Harkup, 2015 The Umbrella Assassin https://www.youtube.com/watch?v=SRUoVSDfYjc
MIDTERM 2 - Oct 20 (first hour, covering weeks 5-8)			
Oct 20 MC (wk 9)	Carbon Monoxide	<ul style="list-style-type: none"> Understand the toxicity of carbon monoxide, and how it works 	Chapter 7, Emsley, 2008 Poisoner's Guide to Communicating

(Midterm2)		<ul style="list-style-type: none"> Learn about the sources of carbon monoxide 	Chemistry https://www.youtube.com/watch?v=QPDwzcppG0o
Oct 27 (wk 10) MEC 1st short presentations	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
Nov 3 (wk 11) 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
Nov 10 (wk 12) MC Quiz 3	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)
Nov 17(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=uLZiKBdMEIc
Nov 24	Thanksgiving Recess		
Dec 1 (wk 14) MC & HG 2nd 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 	https://www.bloomberg.com/news/features/2017-10-26/inside-fort-botox-where-a-deadly-toxin-yields-2-8-billion-drug
RXRS 304 Final Exam: Friday, December 10, 2021 from 2 to 4 pm			

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling

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

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after

hours – 24/7 on call

studenthealth.usc.edu/sexual-assault

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 / Title IX – (213) 821-8298

equity.usc.edu, titleix.usc.edu

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

usc-advocate.symplicity.com/care_report

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

The Office of Disability Services and Programs - (213) 740-0776

dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710

campussupport.usc.edu

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

Diversity at USC - (213) 740-2101

diversity.usc.edu

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

dps.usc.edu, emergency.usc.edu

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) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.