

Department of Environmental Health
Faculty of Health Sciences
American University of Beirut

ENHL 310 / ENSC 640 (3 credits)
Toxicology and Environmental Health Hazards

Course Coordinator:

Hassan R. Dhaini, MSc, PhD

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Office hours: **MW 11:30 -12:30**

Class Time and Location:

Term, Dates and times: Fall Term; **MW 10:00 - 11:15 am**

Classroom: **Van Dyck Hall 101**

Prerequisites:

None

Course Description:

The course presents toxicology in three sections. In the first section, the fundamental principles and essentials of toxicology are introduced, particularly dose-response, toxicokinetics, and cellular mechanisms of action. In the second section, the course discusses toxicity of main organ systems. Classic toxicants that adversely affect health, emerging hazardous human exposures, and special topics, are discussed in the last section of the course. The course includes lecture style presentations, collective case-studies activities, and student led discussions. Topics of local and regional relevance are also introduced through hosting guest speakers.

Course Learning Objectives:

By the end of the course, students will be able to:

1. Explain the toxicokinetic phases and the different routes of entry of toxicants into the human body.
2. Discuss the different mechanisms of cellular toxicity and associated repair.
3. Evaluate a dose-response relationship
4. Summarize the main effects of toxic agents on selected organ systems.
5. Discuss the principles of environmental chemical carcinogenesis and impact of gene-environment interactions on cancer risk.
6. Explain principles of toxicity for classic chemicals and emerging human exposures.
7. Construct the toxicological profile of a chemical hazard.

8. Communicate published findings on selected toxic chemical agents in oral format.
9. Describe components of a human health risk assessment.

Course LOs mapped to MSES-EH Program Distinct Competencies

| Distinct MSES-EH Competencies | LO1 | LO2 | LO3 | LO4 | LO5 | LO6 | LO7 | LO8 | LO9 | Assignment where competency is primarily assessed |
|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|---|
| 1. Identify public health core functions, principles, values and the role of its four disciplines in addressing contemporary population | | | | | | | | | | |
| 2. Explain the role of socioeconomic, political, and cultural factors in shaping environmental health issues in local, national, and global contexts | | | | | | | | | | |
| 3. Describe interlinkages between health, environment and sustainable development | | | | | | I | | | | |
| 4. Apply environmental exposure assessment methods | | | | | | | | | | |
| 5. Examine the associations between environmental exposures and health outcomes | A | A | A | A | A | A | A | | | - Midterm (35%) - Final Examination (30%) - Research Project Presentation (30%) |
| 6. Analyze strategies to prevent, control, and manage environmental health risks | | | | | | | | | I | |
| 7. Integrate theoretical knowledge and research skills to generate scientific evidence that informs environmental policy and impacts decision making | | | | | | | | | | |
| 8. Discuss ethical aspects arising in research and practice in the environmental health field | | | | | | | R | | | |
| 9. Demonstrate oral and written communication skills required for knowledge translation and dissemination | | | | | | | | A | | - Research Project Presentation (30%) |
| 10. Recognize the regulatory and legal framework governing environmental health-related issues in Lebanon and internationally | | | | | | | A | | R | - Final Examination (30%) - Research Project Presentation (30%) |

Distinct competency is: A = primarily assessed; I = introduced; R = reinforced

Course Material Readings:

Suggested Reference Book: Klaassen CD, Watkins JB. Casarett and Doull's Essentials of Toxicology, 3rd Edition. McGraw-Hill Education, 2015. (ISBN-13: 978-0071847087)

The course material includes lecture handouts and reading assignments used for discussion. The lecture handouts and reading material will be posted on Moodle prior to class. If the lecture handouts are not posted on Moodle ahead of class, the course coordinator is responsible for bringing in hard copies to class.

Student Evaluations:

Students will be evaluated as following:

| | | |
|--------------------------------|-------------|-----|
| Midterm examination assessing | LOs 1-4 | 35% |
| Final examination assessing | LOs 5, 6, 9 | 30% |
| Project Presentation assessing | LOs 7-9 | 30% |
| Class Participation | | 5% |

Assessment Methods:

| Assessment method | Date | LOs covered | Grade percentage |
|---|-----------------|-------------|------------------|
| Midterm Examination | Oct 25, 2023 | 1-4 | 35% |
| The format of the Midterm is a combination of MCQ and subjective questions. Evaluation tools will assess both (1) the acquired level of knowledge of the student, and (2) the ability of the student to use provided data or premise in critical reasoning. | | | |
| Research Project Presentation (Group assignment) | Nov 20-27, 2023 | 7-8 | 30% |
| Students are to collaborate on projects in <u>Groups of Two</u> . Each group is expected to prepare a PowerPoint presentation and to present in class. Each member of the group is expected to participate in the presentation. Groups will select from a list of topics to be shared at the beginning of the term (E.g.: <i>Toxicity and health risks associated with Polychlorinated Biphenyls (PCBs) from electronic wastes</i>), or suggest other topics subject to the course coordinator's approval. The presentation is expected to be around <u>25 minutes</u> followed by a <u>20 min</u> Q & A based discussion with the rest of the audience in order to synthesize the literature on the assigned topic, moderated by the course coordinator. Students will be evaluated on the following components: | | | |
| <ol style="list-style-type: none"> 1- Sources of Pollution & Human Exposure 2- Toxicokinetics (A D E) 3- Metabolic Pathway(s) 4- Mechanism(s) of Action 5- Toxicity & Health Risks 6- Regulatory Aspects Prevention & Alternatives 7- Presentation Format 8- Scientific Evidence and Referencing 9- Communication Skills 10- General Understanding of the Topic and Answering Questions | | | |
| (Referencing style: References should be consecutively listed at the bottom of each corresponding slide.) | | | |

| Assessment method | Date | LOs covered | Grade percentage |
|--|------|-------------|------------------|
| References must conform to the Vancouver style [published in British Medical Journal 1979, I, 532-535] | | | |
| Each member of the group will be assessed on their presented components above on a scale of 0-10 as following (both members of the group will be graded separately on above items 9- and 10-): | | | |
| 0: <i>No Response:</i> Task not Attempted 1-2: <i>Unable to begin effectively:</i> restates the question without making an attempt at the answer 3-4: <i>Fails to complete:</i> unclear with major flaws 5-6: <i>Nearly Satisfactory:</i> complete partially with significant aspects missing 7-8: <i>Competent:</i> Clarity of thought/Task completed in general with minor flaws 9-10: <i>Exemplary:</i> Clarity/Complete and Excellent to Outstanding work | | | |
| While one group presents, the other groups will be asked to contribute to the evaluation. | | | |
| Final Examination | TBA | 5-6 | 30% |
| The format of the Final Examination is a combination of MCQ and subjective questions. Evaluation tools will assess both (1) the acquired level of knowledge of the student, and (2) the ability of the student to use provided data or premise in critical reasoning. | | | |

Course Policies

Attendance

You are urged to attend all classes. In cases of absence, you are responsible for the material missed and for any announcement made.

Academic Integrity

Education is demanding and time management is essential. Do not hesitate to use the resources around you but do not cut corners. Cheating and plagiarism will not be tolerated. Please review the Student Code of Conduct in your handbook and familiarize yourself with definitions and penalties. If you are in doubt about what constitutes plagiarism, ask your instructor because it is your responsibility to know. The American University of Beirut has a strict anti-cheating and anti-plagiarism policy. Penalties include failing marks on the assignment in question, suspension or expulsion from University and a permanent mention of the disciplinary action in the student's records.

Students with Special Needs

If you have documented special needs and anticipate difficulties with the content or format of the course due to a physical or learning disability, please contact me and/or your academic advisor, as well as the Counseling Center in the Office of Student Affairs (Ext. 3196), as soon as possible to discuss options for accommodations. Those seeking accommodations must submit the Special Needs Support Request Form along with the required documentation.

Non-Discrimination – Title IX

AUB is committed to facilitating a campus free of all forms of discrimination including sex/gender-based harassment prohibited by Title IX. The University's non-discrimination policy applies to, and protects, all students, faculty, and staff. If you think you have experienced discrimination or harassment, including sexual misconduct, we encourage you to tell someone promptly. If you speak to a faculty or staff member about an issue

such as harassment, sexual violence, or discrimination, the information will be kept as private as possible, however, faculty and designated staff are required to bring it to the attention of the University's Title IX Coordinator. Faculty can refer you to fully confidential resources, and you can find information and contacts at www.aub.edu.lb/titleix. To report an incident, contact the University's Title IX Coordinator at 01-350000 ext. 2514, or titleix@aub.edu.lb. An anonymous report may be submitted online via EthicsPoint at www.aub.ethicspoint.com.

Privacy Statement

By signing up for this course, you confirm that you have read and accepted the terms and provisions of [AUB's Privacy Statement](#).

List of Lecturers:

Dr. Hassan Dhaini, Toxicologist
Associate Professor / AUB Department of Environmental Health
hd24@aub.edu.lb

Dr. Ola El Zein, Librarian
Head, Saab Medical Library
oe14@aub.edu.lb

Course Outline*: a session is 1 hr. 15 min

| Sessions /Dates | Topic | Content | Reading | Relevant Assignment |
|---|---|--|---|-------------------------------|
| SECTION I: General Principles | | | | |
| 1 M Aug 28 | Course Overview | <ul style="list-style-type: none"> Content and Requirements Definitions | | Midterm |
| 2 W Sep 30 | Introduction to Toxicology | <ul style="list-style-type: none"> Introducing the field of Toxicology Classification of toxic agents | Handout | Midterm |
| 3 M Sep 04 | Dose-Response | <ul style="list-style-type: none"> Dose-Response relationship (D-R) Interpreting D-R Curve Toxicity/Safety Indicators | Handout | Midterm |
| 4 W Sep 06 | Determinants of Toxicology | <ul style="list-style-type: none"> Toxicological data applications Variables in health risk Toxicology and SDGs | Handout | Midterm |
| 5 M Sep 11 | Toxicokinetics I | <ul style="list-style-type: none"> Routes of exposure Absorption | Handout | Midterm |
| 6 W Sep 13 IT Depart. Computer Lab | Tox Library Resources | <ul style="list-style-type: none"> Applied session to acquire skills in the use of Medical & Toxicology related library resources | | Research Project Presentation |
| 7 M Sep 18 | Toxicokinetics II Choose a Research Project Topic and Submit by Email by Midnight | <ul style="list-style-type: none"> Distribution and storage Excretion of toxic compounds | Handout | Midterm |
| 8-9 W Sep 20 M Sep 25 | Toxicokinetics III | <ul style="list-style-type: none"> Biotransformation Metabolic pathways Parameters of biotransformation | Handout | Midterm |
| W Sep 27 | No Class: Prophet's Birthday | | | |
| 10-11 M Oct 02 W Oct 04 | Mechanisms of cellular Toxicity | <ul style="list-style-type: none"> Cellular organization Toxic Intermediates Toxic outcomes | Handout | Midterm |
| 12 M Oct 09 | Case-Study 1 | <i>TBA</i> | Case-Study material will be shared In-class | Midterm |

| SECTION II: Organ System Toxicity | | | | |
|--|---|--|---|---------|
| 13 W Oct 11 | Hepatotoxicity | <ul style="list-style-type: none"> • Liver structure & functions • Hepatotoxic agents • Zonal injury • Liver toxicity Indicators | Handout | Midterm |
| 14 M Oct 16 | Nephrotoxicity | <ul style="list-style-type: none"> • Kidney structure and functions • Nephrotoxic agents • Kidney toxicity indicators | Handout | Midterm |
| 15 W Oct 18 | Respiratory System Toxicity | <ul style="list-style-type: none"> • Respiratory system structure & functions) • Defense mechanisms • Types of Lung Injury • Respiratory toxicants | Handout | Midterm |
| SECTION III: Special Topics | | | | |
| 16 M Oct 23 | Principles of Metals Toxicity | <ul style="list-style-type: none"> • General principles • Select metals toxicity | Handout | Final |
| W Oct 25 | MIDTERM: Sessions 1-15 | | | |
| 17 M Oct 30 | Principles of Organic Compounds Toxicity | <ul style="list-style-type: none"> • General principles • Classes of organic compounds • Select compounds toxicity | Handout | Final |
| 18 W Nov 01 | Case-Study 2 | <i>TBA</i> | Case-Study material will be shared In-class | Final |
| 19 M Nov 06 | Principles of Chemical Carcinogenesis | <ul style="list-style-type: none"> • Mutagenicity • Classification of Carcinogens • Carcinogenic Genetic damage. Stages of neoplastic development • Prevention | Handout | Final |
| 20 W Nov 08 | Gene-Environment Interaction | <ul style="list-style-type: none"> • Principles of Interaction • Low Penetrance Genes • Models of G/E interaction in Cancer | Handout | Final |
| 21 M Nov 13 | Persistent Organic Pollutants & Pesticides, and | <ul style="list-style-type: none"> • Organophosphates & other pesticides • Persistent Organic Pollutants | Handout | Final |

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|--|--|---|-------------------------|---|
| | beyond | <ul style="list-style-type: none"> Dioxins | | |
| 22 W Nov 15 | Introduction to Risk Assessment | <ul style="list-style-type: none"> Overview of the components of Risk Assessment | Handout | Final |
| 23-24 M Nov 20 | Student Research Project Presentations I | | | Research Project Presentation/ Final |
| W Nov 22 | No Class: Independence Day | | | |
| M Nov 27 | Student Research Project Presentations I | | | Research Project Presentation/ Final |
| 25-26 W Nov 29 Extended session | Case-Study 3 | TBA | Projection & Discussion | Final |
| TBA by Registrar | FINAL EXAMINATION: sessions 16-26 <i>(including students research projects)</i> | | | |

***Changes in the timetable may occur during the term**

Course Withdrawal end period: **November 17, 2023**

Reading Period: **December 01, 2023**