FOOD 525 Food Toxicology and Risk Assessment

**Course Details**

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| Course | FNH 525 Food Toxicology and Risk AssessmentI [3] (hours/week of [lecture]) |
| Prerequisites | BSc. |
| Term/year | Winter term 1 (September - December 2020) |
| Class day/time | Mon/Fri 20:00-21:30; |
| Class location | Online |
| Instructor | David Kitts |
| Email | [david.kitts@ubc.ca](mailto:david.kitts@ubc.ca) |
| Office | FNH Building, room 243; 604-822-5560 |
| Office hours | TBA |
| TA | Ted Yu, [tedyu@mail.ubc.ca](mailto:tedyu@mail.ubc.ca) |
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| Syllabus version | September 2020 |

**Instructor’s Biographical Statement**

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| Dr. David D. Kitts | MSc. - UBC (76’), Ph.D - UBC (81’); PDF. - UCD (83’) |
| Rank | Professor |
| Program | Food Science; Food, Nutrition and Health |
| Specialty Disciplines | Food Chemistry; Toxicology |
| Current courses taught at UBC | FNH 301 Food Chemistry  FOOD 525 Food Toxicology and Risk Assessment |
| Research Interests | Bioactives; Food Lipids and Antioxidants  Food Processing - Nutritional/Toxicological Quality & Safety |
| Administration | Associate Dean Research, Faculty of Land and Food Systems |
| Advisory Boards | Canadian Sugar Council (CSI)  International Life Sciences (ILSI) - North America |

**Course Description.**

**Food chemical toxicology is an important scientific discipline, which studies the source, makeup and formation of chemical toxicants in foods; the evaluation and development of methods for detection and analysis of potential risk for deleterious effects on consumers. The manifestations and mechanisms of toxicokinetic behavior and the analysis of risk/benefit assessment attributed to the presence of xenobiotics in food is also a vital component for Food Toxicologists.**

**Objectives**

FOOD 525 will develop students’ theoretical knowledge of food toxicology and risk assessment working prinicples and critical thinking skills for employment in the food industry and to communicate food toxicology applications to a variety of audiences. Major topic areas include prinicples of toxicokinetics, natural toxicants, processed, derived toxicants, environmental toxicants. These topics are addressed using DOPER concepts to describe their safety characteristics and management methods. Risk Assessment priniciples are introduced to enable quantitative risk analysis on the relevance of potential toxicity to the consumer and how to communicate the risk.

**Learning Outcomes**

By the end of FOOD 525, students will be able to:

1. Distinguish Food Toxicology principles from other Toxicology Disciplines.
2. To be informed on topics specific to the Source of Toxicants, Traceability Systems employing DOPER concept.
3. To be introduced to Principles of Toxicokinetics
4. To be informed on specifics related to Natural Toxicants: shellfish toxins; mycotoxins, bioactives; Derived toxicants: food processing derivatives, additives; agricultural-environmenta toxins: pesticides, heavy metals; Screening Procedures; Risk Assessment.
5. Discuss the complex nature and mechanism of action of food toxicants to the living system.
6. Explain the underlying structure-function components of toxicants that increase risk.
7. Explain the biochemical transformation/accumulations of food toxicants and associated
8. Understand the prinicples of Risk Assessment and apply tools to manage and communicate risk/hazard to consumer.

**Course Format**

There are 2 one-and-half hour class lectures in traditional format given per week by the Instructor that cover major topics (see below), considered basic first principles for understanding the principles of food toxicology and risk assessment. mical and enzymatic reactions that occur in foods.

Lectures are supplemented with group projects on given topic related to current food –chemical toxicology examples. Students will work in groups of four to preparae an oral and written group presentation of these topics. Groups will apply DOPER concepts to communicate their understanding of the toxicology prinicples related to each food toxin provided to them. They will also incorporate relavent Risk Assessment tools to communicate the risk to human safetStudent oral group presentations on topics of Food Toxicology will be designed where students lead the class discussion on the purpose and objective of the tresearch topic, experimental designs used to generate relevant data on the food toxin, and an objective discussion of data that has lead to conclusions in the area. A class outline will be prepared for other students to become familiar with the topic so that they can make meaningful contributions to the seminar.

Due to Covid-19, this year the course will have both synchronous and asynchronous online lectures and presentations. Group projects will still include student presentations and a written summary document for the class.

Traditional lectures - face-to-face lectures with online notes

Oral presentation and written reports - students research topics in groups, produce an oral presentation and written report

**Learning Activities**

Student participation is encouraged in class by working in small groups to assimulate knowledge on specific (contemporary/novel) topics important for a food toxicologis. Question and answer periods are provided after each section of the course content. Specific readings are introduced for students to expand their knowledge on related food chemistry topics (see references below).

**Course Readings**

Reference resource textbook

Food Toxicology Volms. 1 and 2. Concon, J.R.

Class lecture notes presented on Canvas

Supplemental reading

Kitts, D.D. (2019). Dietary Lipids and Physiological Function. In F. Shahidi (Ed.), *Bailey’s Industrial Oil and Fat Products* (7th ed.) Manuscript ID biof.20160105.

Journals helpful for group projects

* Food Chemical Toxicology-
* Food Agriculture Food Chemistry
* J. Toxicology Environmental Health.

**Weekly Course Schedule**

An introductory lecture to enable the student to distinquish the unique priniciples of food toxicology to other related toxicology disciplines (e.g nutritional toxicology; pharmacology etc.).

Lectures 1 &2: Definition and classifications of Food Toxicology;  
DOPER concept: Dose-Response Curve; Toxicokinetics of potentially hazardous agents   
Basic principles of absorption, distribution (accumulation), biotransformation, excretion ; Traceability concept.

Lectures 3 & 4: Natural Toxicants

Natural toxicants (antinutrients; preservatives: benzoic acid and sodium benzoate;Sweeteners: Saccharin, Aspartame, Sucralose Coloring agents); Food allergens (immunological and non-immunological reactions),and sensitivity (intolerances); Biogenic toxicants of plant origin.

Lecture 5 Marine Toxicants.

Toxic constituents of marine origin: Marine toxins:(Paralytic Shellfish Poisoning; Puffer fish (tetrodotoxin), ciguatera poisoning (ciguatoxin)).

Lecture 6: Toxic constituents of fungal origin: mycotoxins

Toxic aflatoxins, occurance, mechanisms of action; ugot.

Lecture 8: Derived Toxicants: Reaction products:

a) PAH’s; b) Heterocyclic amines, c) Acrylamide, c)Nitrates, nitrites and nitrosamines

Lecture 9. Intentional Toxicants (Environmental/Agricultural

Heavy metal contamination; antibiotics; pesticides.

Lecture 10. Methods of food toxicant measurement.

Analytical and biological (bioassay)

Lecture 11. Risk Assessment Concepts in Food-Chemical Toxicology

Concept of risk assessment (Risk vrs Hazard) ; measurement; communication and management.

**Course Assessment**

Students will be graded for class participation that involve the group oral projects. Research Papers will be in the field of Food Toxicology and should be a collective effort with all group members contributing. Topic for term paper will be provided by the professor or will require consolation if other interests exist.\*= a group peer review will be requested by each group member on the participation of their co-workers.

The course is graded on a numeric percentage as follows:

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| Midterm exam | 25% |
| Class-tutorial participation | 5% |
| Group project/oral+report | 30% |
| Final exam | 40% |

**Learning Analytics**

Learning analytics include the collection and analysis of data about learners to improve teaching and learning. This course will be using Canvas learning technologies and its integrated tools.

**Academic integrity**

FOOD 525 brings forth important examples of ethics relevant to food industry activities. Student conduct in the academic enterprise that focuses on class activities is founded on student honesty, civility, and integrity for the establishment of individual reputation. All UBC students are expected to behave as honest and responsible members of an academic community. At the most basic level, this means submitting only original work done by the student, and acknowledging all sources of information, or ideas, attributed to others are required. There is zero tolerance for cheating, copying or misleading others about the student’s original work. It is emphasized that this code of conduct at University is also the code of conduct that professionals in the food industry must follow.

The University of BC considers it to be the student's obligation to learn, understand and follow the standards for academic honesty and integrity. Students are made aware that standards at the University of British Columbia may be different from those in secondary schools or at other institutions.

Violations of academic integrity lead to the breakdown of the academic enterprise, and therefore serious consequences follow. Plagiarism or cheating may result in a mark of zero on an assignment, exam, or course. More serious consequences may apply if the matter is referred to the President’s Advisory Committee on Student Discipline. Academic misconduct may result in a one-year suspension from the University and a notation of academic discipline on the student's record.

The [UBC library](http://guides.library.ubc.ca/tutorial-lfs/citing/plagiarism) has a useful Academic Integrity website that explains what plagiarism is and how to avoid it. If a student is in any doubt as to the standard of academic honesty in a particular course or assignment, then the student must consult with the instructor as soon as possible. A more detailed description of academic integrity, including the University’s policies and procedures, may be found in the [Academic Calendar](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,54,111,958). All course work is required to be submitted to Turnitin.com for review.

**University Policies**

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are availableon[**the UBC Senate website**](https://senate.ubc.ca/policies-resources-support-student-success)**.**

**Copyright**

All materials of this course (course handouts, lecture slides, assessments, course readings, etc.) are the intellectual property of the Course Instructor or licensed to be used in this course by the copyright owner. Redistribution of these materials by any means without permission of the copyright holder(s) constitutes a breach of copyright and may lead to academic discipline.

Students are allowed to record my classes if they first approach me to explain the reasons for this activity.

**Institute of Food Technologists (IFT)**

![A close up of a sign

Description automatically generated]()UBC’s Food Science Program is one of few in Canada that are approved by the Institute of Food Technologists (IFT), an internationally recognized leader in undergraduate education standards for degrees in Food Science. Programs with this approval badge are recognized as delivering a comprehensive Food Science education that covers 55 essential learning outcomes (ELOs) established by the IFT organization. For further information on IFT ELOs, click [here](https://www.ift.org/-/media/community/educators-herb/2018herbguidelinesforinitialiftapproval1.pdf?la=en%5C046hash=559ED853B136E7DD47C812C14B478DE32B4CBEF5). The highlighted ELOs below are covered in this course.

**Institute of Food Technologists Essential Learning Objectives (IFT ELOs)**

IFT ELOs that are highlighted in bold from the list below are covered in FOOD 525. They are also summarized here as: **Food Chem.(FC) FC 1,2,3,4; Food safety (FS) FS 1,2,3; Food Engineering (FE) FE 6; Quality Assurance (QA) QA 3. Critical Thinking and Problem Solving (CTPS) CTPS 2,3; Food Science Communication (CM) CM 2,3; Professional Leadership (PL) PL 1,2,4**

**Food chemsitry (FC)**

**FC.1. Discuss the major chemical reactions that describe a food toxicanat using DOPER.**

**FC.2. Explain the chemistry underlying the properties and reactions of various food toxicants, natural vrs derived vrs intentional.**

**FC.3. Apply food chemistry principles used to control toxic reactions in foods.**

**FC.4. Review chemical techniques that explain basic and applied food chemical toxicology.**

FC.5. Demonstrate practical proficiency in a food analysis laboratory.

FC.6. Explain the principles behind analytical techniques associated with food.

FC.7. Evaluate the appropriate analytical technique when presented with a practical problem.

FC.8. Design an appropriate analytical approach to solve a practical problem.

**Food microbiology (FM)**

FM.1. Identify relevant beneficial, pathogenic, and spoilage microorganisms in foods and the conditions under which they grow.

FM.2. Describe the conditions under which relevant pathogens are destroyed or controlled in foods.

FM.3. Apply laboratory techniques to identify microorganisms in foods.

FM.4. Explain the principles involved in food preservation via fermentation processes.

FM.5. Discuss the role and significance of adaptation and environmental factors (e.g., water activity, pH, temperature) on growth response and inactivation of microorganisms in various environments.

FM.6. Choose relevant laboratory techniques to identify microorganisms in foods.

**Food safety (FS)**

**FS.1. Identify potential hazards and food safety issues in specific foods.**

**FS.2. Describe routes of physical, chemical, and biological contamination of foods.**

**FS.3. Discuss methods for controlling physical, chemical and biological hazards.**

FS.4. Evaluate the conditions, including sanitation practices, under which relevant pathogenic microorganisms are commonly controlled in foods.

FS.5. Select appropriate environmental sampling techniques.

FS.6. Design a food safety plan for the manufacture of a specific food.

**Food engineering and processing (FE)**

FE.1. Define principles of food engineering (mass and heat transfer, fluid flow, thermodynamics).

FE.2. Formulate mass and energy balances for a given food manufacturing process.

FE.3. Explain the source and variability of raw food materials and their impact on food processing operations.

FE.4. Design processing methods that make safe, high-quality foods.

FE.5. Use unit operations to produce a given food product in a laboratory or pilot plant.

**FE.6. Explain the effects of preservation and processing methods on product quality.**

FE.7. List properties and uses of various packaging materials and methods.

FE.8. Describe principles and practices of cleaning and sanitation in food processing facilities.

FE.9. Define principles and methods of water and waste management.

**Sensory science (SS)**

SS.1. Discuss the physiological and psychological basis for sensory evaluation.

SS.2. Apply experimental designs and statistical methods to sensory studies.

SS.3. Select sensory methodologies to solve specific problems in food.

**Quality assurance (QA)**

QA.1. Define food quality and food safety terms.

QA.2. Apply principles of quality assurance and control.

**QA.3. Develop standards and specifications for a given food product.**

QA.4. Evaluate food quality assessment systems (e.g. statistical process control).

**Food laws and regulations (FL)**

FL.1. Recall government regulatory frameworks required for the manufacture and sale of food products.

FL.2. Describe the processes involved in formulating food policy.

FL.3. Locate sources of food laws and regulations.

FL.4. Examine issues related to food laws and regulations.

**Data and Statistical Analysis (DS)**

DS.1. Use statistical principles in food science applications.

DS.2. Employ appropriate data collection and analysis technologies.

DS.3. Construct visual representation of data.

**Critical thinking and problem solving (CT)**

CT.1. Locate evidence-based scientific information resources.

**CT.2. Apply critical thinking skills to solve problems.**

**CT.3. Apply principles of food science in practical, real-world situations and problems.**

CT.4. Select appropriate analytical techniques when presented with a practical problem.

CT.5. Evaluate scientific information.

**Food Science Communication (CM)**

**CM.1. Write relevant technical documents.**

**CM.2. Create oral presentations.**

CM.3. Assemble food science information for a variety of audiences.

**Professionalism and leadership (PL)**

**PL.1. Demonstrate the ability to work independently and in teams.**

**PL.2. Discriminate tasks to achieve a given outcome.**

PL.3. Describe social and cultural competence relative to diversity and inclusion.

**PL.4. Discuss examples of ethical issues in food science**