FOOD 4002

- Analysis of Food Contaminants -

Course outline

Winter 2024

David McMullin and Trinda Crippin

FOOD 4002

Analysis of Food Contaminants

Contact information and schedule

Contacts

Instructor: David McMullin
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Lab Coordinator: Winifred Akoetey
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Teaching Assistant: Paul Heidarian
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Lab session: **Monday 08:35 am–12:25 pm** **SC409**

Tutorial: **Thursday 1:35 pm–2:25 pm** **SA505**

LAB SCHEDULE

Week starting (Monday)	**Laboratory topic**	**Due date** (before 11:59pm)	
		Pre-lab	**Assignments**[1]
Jan 8	No lab – Complete course outline, lab safety and WHMIS online		Jan 14
Jan 15	Exp. 1: Chloramphenicol in honey	Jan 14	
Jan 22	Exp. 1: Chloramphenicol in honey		Jan 28
Jan 29	Exp. 2: Deoxynivalenol – DNA extraction	Jan 28	
Feb 5	Exp. 2: Deoxynivalenol – PCR and electrophoresis		
Feb 12	Exp. 2: Deoxynivalenol – Chemical extraction		Feb 18
Feb 19	Winter break		
Feb 26	Exp. 3: Glycoalkaloids	Feb 25	
Mar 4	Exp. 3: Glycoalkaloids		Mar 10
Mar 11	Exp. 4: Phytosterol oxidation products in coffee	Mar 10	
Mar 18	Exp. 4: Phytosterol oxidation products in coffee		Mar 24
April 1	Lab exam (in-person)		TBD
April 8	Written assignment due		TBD

[1] = Lab reports, reflection assignments, Lab exam and Written assignment

The first week the students are expected to complete a pre-lab, watch/read the content provided and complete an in-person laboratory session. The proceeding week(s) may require the students to come in for in-person experiment or tutorial session and for the student to hand in a full lab report and a reflection assignment.

Evaluation and grading - Mark breakdown

The overall mark for FOOD4002 and is made up of the following components:

Pre-lab questions:	10%
Technique/Safety:	10%
Written assignment:	10%
Lab reports:	50%
Reflection assignments	10%
Lab exam:	10%

Important:
You are required to complete and submit ALL reports for every experiment performed. Regardless of completeness and due date. Failure to hand in all reports will result in an in automatic grade of F for the course.

All late learning activities and assignments will be penalized **10% per day** and will result in a grade of zero after 3 days (unless satisfactory arrangements have been made with the Laboratory Coordinator well in advance of the due date). Weekends are counted as 2 days, therefore resulting in 20% off. All assignments must be handed in during the semester regardless of the date. Otherwise the final grade will result in an incomplete.

Pre-lab questions

Pre-lab questions are due nights before 11:59 pm on the week of the first session of each experiment. The Pre-lab quiz is available in Brightspace under the respective experiment module. They will be made available one week before the experiment to give ample time for completion.

The pre-lab questions must be completed prior to attending the lab session, to ensure you understand the experiment. Pre-lab questions will pertain to: concepts, techniques, reactions, specimens, hazards, calculations and observations needed for this experiment.

Technique

Your TA will assess your experimental technique for each lab period. The grade they give will be based on the following criteria:

- Proper execution of the experiment.
    - Demonstrate knowledge of the techniques involved (learned from reviewing content on Brightspace).
- Keeps lab area and common areas clean and tidy.
    - Always ask your TA if you are unsure about disposal or cleaning procedures.
    - Sink, balance area, surrounding instruments and equipment.
    - Keeps the common walking paths clear of backpacks and stools.
- Minimizes the amount of reagents and lab material used.
    - For example: The student is preparing the reagents needed for the next portion of the experiment. Roughly 15 mL of Solvent A is needed, so the student obtains 15-20mL at the solvent station. This is reasonable. If the student obtained 50 mL, this would be unreasonable and a waste of reagent.
- Minimizing experimental errors by avoiding chemical spills and breakage.
    - Careful handling of chemicals.
    - Proper and efficient use of laboratory equipment and instrumentation.
- Paying attention during the experiment and not distracted by others or electronics.
- Consideration of others in matters of safety and common courtesy.

Safety

You are required to follow lab safety protocols at all times. Failure to do so will result in points being decreased, or removal from the laboratory. You must wear safety goggles and lab coat at all times in the laboratory. Proper clothing and footwear must be worn in the lab. Sandals or shoes that do not cover the entire foot (open toed shoes, flats, etc.) are not permitted. Bottoms must cover the entire leg down to the shoes. Long hair should be tied back and tucked into the back of the lab coat. You will not be allowed to perform the experiment if you are not dressed in the proper attire.

Laboratory gloves must be worn when handling any chemical, equipment or instrument in the laboratory. If at any point your gloves rip or become contaminated by chemicals, please replace them. Gloves are to be removed before leaving the lab.

Eating, drinking and smoking are not permitted in the laboratory. Ensure you have a snack or meal before your laboratory session. Water bottles are permitted as long as they can remain concealed in your backpack under the benchtop. You must carry the water bottle into the hall to drink.

Many of the experiments in this course involve food products. These items are not to be eaten or drank during the experiment. This is absolutely not permitted. There is potential for mixing with dangerous reagents, rendering the food product unsafe to consume. The food products are strictly for laboratory use only.

All chemicals are potentially poisonous and corrosive. Many organic chemicals, especially solvents, are flammable and explosive. Any spills must be cleaned immediately. No chemical is allowed to be used outside of the laboratory.

If you are unsure about disposal, please ask your TA or Lab Coordinator. Never return unused chemicals to a reagent or solvent container. Waste can be divided into the following categories:

1. Regular waste – For items like paper towel wet with water, spent tape, pencil shavings etc.
2. Glass waste – for disposal of used and rinsed Pasteur pipettes, broken glassware.
3. Organic liquids – dispose in organic waste container provided in the fumehood.
4. Organic solids – dissolve in the appropriate solvent and dispose in the organic waste container.
5. Inorganic solids should be wrapped in paper towel and disposed of in the regular waste.
6. Aqueous solutions – wash down the sink with plenty of water.

Each laboratory is equipped with a fire extinguisher, safety showers, eye wash stations, and a first aid kit. In the Food Science teaching lab (SC409) these safety stations are all located by the door. If there is an emergency, notify the TA and Lab Coordinator immediately. If Carleton Campus Safety Services are needed, call Ext. 4444 on lab phone (south facing wall).

Written assignment

Select an instrumental method or analytical tool commonly used to examine chemical, microbial, or physical food safety issues. Emphasis should be placed on how the instrument functions and how it helps solve food safety problems. For your selected analytical instrument, demonstrate how it helps solve a specific food safety issue. For example, using LC-MS/MS to quantify regulated potato glycoalkaloids would be suitable (come up with your own food safety issue, the ones covered in class are not allowed).

Confirm your instrumental method and food safety issue with the instructor David McMullin. Assignments are expected to be 10-12 double spaced pages using a standard font (i.e. Times New Roman, font 12). There will be an emphasis on writing style: write in a clear, concise manner with a logical progression. Reference peer-reviewed journal articles, books and reports as appropriate. Page limit does not include references, tables, or figures. A more comprehensive marking scheme will be given when assigned.

Laboratory Reports

Laboratory reports are due Sunday nights before 11:59 pm on the week that the next experiment starts. These reports are to be submitted online through the respective submission box on Brightspace.

It is expected that fourth-year students should be capable of writing reports in a proper scientific manner (third person; past tense; proper citation within the text as well as in the references section; properly labeled tables and figures; one sample of each calculation performed (when appropriate); the genus and species name of microorganisms should be *italicized*).

Each lab report should contain approximately 9-13 pages including references. The important thing is not the number of pages, but rather the content of the report. We hope you will be able to give us all the information necessary in the report without using an excessive number of pages.

Late reports will be penalized **10% per day** and will result in a grade of zero after 3 days (unless satisfactory arrangements have been made with the Laboratory Coordinator well in advance of the due date). Weekends are counted as 2 days, therefore resulting in 20% off. All assignments must be handed in during the semester regardless of the date. Otherwise the final grade will result in an incomplete.

The **full reports** will be graded out of 100 and will include all sections listed below.

The marking scheme for reports will be as follows:

1. Format (5 marks)

Typed; double-spaced; Times New Roman font, size 12
Neatness
Spelling and grammar
Proper use of scientific language (fourth year standing level)
Submitted as a Word document

2. Cover page (1 page) (0 marks)

The title of the lab
Name
Date of completion

3. Abstract (1 paragraph) (5 marks)

A brief statement (four to five sentences) describing your objective(s), results and their meaning in the context of food safety. The reader should be able to assess the value of your experiment based on this section. Be concise and include important characterization data (this can include contaminant amounts) and if these amounts are above or below regulatory thresholds.

4. Introduction (2-3 pages) (20 marks)

The introduction is a statement of the fundamental principles of the experiment and discussion of how these principles relate specifically to the experiment. Use references as appropriate in this section (include in text citations). The laboratory manual is not a suitable reference- the primary literature must be consulted (journal articles, text books and book chapters). You may make use of figures or tables in this section to highlight important aspects of the experiment. This section should be 2-3 double-spaced pages, exclusive of tables/figures.

5. Methods (1 page) (10 marks)

This section should be in third person, past tense and should describe all techniques performed. It should also contain information about the materials (e.g., microbial material, plant material, dairy material) and the equipment used in the analysis. Your methods should not be a repetition of the step by step procedure. They are a brief yet precise account of what you did. Do not simply recopy the lab manual protocols. If any steps were changed include these changes (e.g., weighed amounts, volumes of reagents, reaction times, temperatures, etc.). The lab manual protocols contain technical information that does not belong in a Methods section of a scientific report. Therefore, provide enough detail that another researcher or student could replicate your experiment, but focus on brevity. Avoid unnecessary detail that is not relevant to the outcome of the experiment such as indicating beaker, flask and pipette sizes; indicating that you dipped your spreader in ethanol and flamed off the excess ethanol, etc.

6. Results (2-3 pages depending on amount of data obtained) (25 marks)

This section should include all data collected (in tables and graphs when possible) followed by any calculations performed including statistics such as standard errors. Each table and graph should be numbered. Explain units and abbreviations. List observations for products. Always include physical observations such as colour, texture, consistency, etc. where applicable. Include sample numbers, names, and sample calculations. Include statistics (standard errors and standard deviations), analytical calculations (LOD, LOQ, contaminants amounts), and comparisons to known values or regulatory limits. Show your units - your calculations are meaningless without them. It is highly recommended to briefly explain what each of your calculations are showing. Ensure that this section is clear and easy to follow by the reader.

Figure titles should be placed below the figure, and table titles are to be placed above the table. Both titles should briefly describe the content. You need to state in words the content of your tables and figures. You cannot simply repeat the data from your tables and figures. You must indicate which samples/treatments were better than the others or the control (based on the statistics) and by how much (e.g., 40% less, 2-fold higher, etc.).

7. Discussion (3-5 pages) (25 marks)

This section is not simply a restatement of your results. You must provide analysis and insight in this section to demonstrate your understanding of your findings. Relate your results and

observations to the theory and purpose of the experiment. This section is used to explain your results.

- Discuss data mentioned in the results section in detail (reference table and figures) and in terms of the purpose of the experiment. Did you manage to fulfill the purpose and what evidence do you have to support this claim?
    - Your results in the context of food/feed safety must be discussed.
- Reference important primary literature and relevant Canadian and/or International thresholds or guidelines (i.e. maximum limits for chemical contaminants).
    - It is important to compare your results to similar work in the scientific literature by referencing high quality peer-reviewed journal articles.
- Discuss comparisons of different regulatory approaches or thresholds need to be discussed.
- You will need to comment on advantages and limitations of the analytical approach used in the laboratory to address your food safety problem(s). Refresh and explain some basic theory using your results and observations.
    - Discuss other analytical approaches, and their intrinsic advantages and limitations.
- There may be specific points to consider that are addressed in your laboratory manual. You must discuss these points in this section.

8. References (10 marks)

The mark will be based on the quality of references used (journal articles containing the appropriate information) and the format. Each lab report should contain at least 4 reputable resources.

a. Within the text your references should be in the format: (author(s), date).
Example:
… was previously shown to possess antimicrobial activity (Crippin et al., 2020; Crippin and McMullin, 2019).

b. In the reference list at the end of the report, the format should be: author #1 last name, first name(s) initial(s), author #2 last name, first name(s) initial(s), etc. (Year). Title of article. *Journal Name*, Volume: pages.
Example:
McMullin, D.R., Hoogstra, S., McDonald, K.P., Sumarah, M.W. & Renaud, J.B. (2019). Natural product discovery with LC-MS/MS diagnostic fragmentation filtering: application for microcystin analysis. *Journal of Visualized Experiments*, 147: e59712.

Aiken, A., Miller, J.D. and McMullin, D.R. (2019). Isolation, chemical characterization and hydrolysis of the trichothecene 7α-hydroxy, 15-deacetylcalonectrin (3ANX) from *Fusarium graminearum* DAOMC 242077. *Tetrahedron Letters*, 60: 852-856.

Reflect and Look Ahead assignment

Reflection assignments are due Sunday nights before 11:59 pm on the night before the next experiment starts. These reports are to be submitted online through the respective submission box on Brightspace.

At the end of each experiment, you will be asked to complete a short reflection assessment. These reflective assessments help 'close the learning loop' on given concepts. Reflecting on what you have learned and how learning took place will solidify your knowledge and increase your awareness of learning approaches that work for you, such that you can use them again in the future. The reflections may also help you draw connections between different concepts within this course, and beyond. These short assignments will not ask you to explain what you have learned. Instead, they will prompt you to reflect on your learning process in order to review and reflect on the learning experience (the lab experiment) and to look forward.

Assessment questions (online worksheets in Brightspace):

a. In your opinion, what are the two most important points you learned from this week's experiment, learning activities, and assignments?
b. What did you find most challenging about learning these concepts, performing the learning activities and/or preparing the assignment(s)? Why do you think this was challenging for you?
c. In your opinion, how do you think these experiments, activities, and assignments connect to the course?
d. In your opinion, how do you believe you can use this week's experiments, activities, and assignments toward learning in this course going forward?

	Not Attempted	**Beginning**	**Developing**	**Competent**	**Exemplary**
Reflection on Learning Process	Does not describe learning experience. 0 marks	Describes learning experience. 2 marks	Describes learning experience with limited insight into how learning occurred. 4 marks	Examines learning experience to provide insight into how learning occurred. 6 marks	Examines learning experience to provide insight into how learning occurred and how this may add to previous or future knowledge acquisition. 8 marks
Clarity	Does not include enough content to communicate ideas. 0 marks	Communicates ideas in a way that is unclear and wordy. 0.5 marks	Communicates ideas in a way that is sometimes unclear and wordy. 1 mark	Communicates ideas in a way that is mostly clear and concise. 1.5 marks	Communicates ideas in a way that is clear and concise. 2 marks

Lab Exam

Lab exam is scheduled in-person. More information will be provided closer to the examination date. Can expect 5-10 long answer questions.

Laboratory attendance and participation

Please note that successful completion of the laboratory work is required to pass the course. In the event that a student misses a scheduled laboratory session, a make-up laboratory may be possible under certain conditions. This is applicable for all evaluations. Among the required conditions:

1. A request for a make-up lab must be made in writing (e.g., by email) to the lab coordinator no later than 24 hours after missing the lab session; and
2. A request for deferral must be fully supported by mean of appropriate documentation, which must include the following form https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf. This should be submitted to the Lab Coordinator through email, no later than one working day after the missed lab session.

Lab exemptions

Students who have already completed the lab portion of the course (within the past 3 years and received a grade of ≥50% in the lab portion) qualify for a lab exemption. A lab exemption allows students to replace their lab grade for the current semester with the lab grade they achieved when they previously took the course. These students will not be required to complete labs, and can focus on the lecture portion of the course.

To be approved for lab exemption, students must notify the Lab Coordinator before January 19th 2024. Late requests will not be granted.

Special information for COVID-19 Pandemic Measures

Symptom reporting and assessment through cuScreen is no longer required. If you feel ill or exhibit COVID-19 symptoms please stay home until you are feeling better.

Masks are not required on campus. However, personal preferences regarding optional mask use will vary, please show respect for the choices of others.

Hand sanitizer will also continue to be available at all building entrances.

Minimum technological needs

In order to use the tools on Brightspace effectively, a desktop or laptop computer and a reliable internet connection are **highly recommended**. In order to access content (documents, videos and other content/resources), perform learning activities, and submit assignments, the following is also recommended:

a) The latest version of your web browser(s): Chrome or Firefox are highly recommended. Some functionality tools are not compatible with other browsers. Safari should be avoided.
b) Make sure you have pop-ups and cookies enabled.
c) The latest version of Java (www.java.com) is also recommended.
d) The recent version of MS Office such as MS Office 365 Pro Plus for Mac or PC (available free for Carleton University students at (https://carleton.ca/its/ms-offer-students/)
e) In the case an online meeting is needed, a headset, headphones, earphones/earbuds or similar technology are highly recommended.

Requests for academic accommodation

You may need special arrangements to meet your academic obligations during the term. Please see the following link for additional information https://students.carleton.ca/course-outline/. For an accommodation request, the processes are as follows:

Students with Needs Related to Family Status: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the following website: https://carleton.ca/equity/.

Student with Religious Obligations: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the undergraduate calendar at the following website: https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/regulations-for-students-with-religious-obligations/.

Students with disabilities requiring academic accommodations in this course must register with the Paul Menton Centre for Students with Disabilities (PMC) for a formal evaluation of disability-related needs. Documented disabilities could include but are not limited to mobility/physical impairments, specific Learning Disabilities (LD), psychiatric/psychological disabilities, sensory disabilities, Attention Deficit Hyperactivity Disorder (ADHD), and chronic medical conditions. Registered PMC students are required to contact the PMC, 613-520-6608, every term to ensure that I receive your Letter of Accommodation, no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. For more details visit the undergraduate calendar at the following website: https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/regulations-for-students-with-disabilities/.

Academic Misconduct

The consequences of copying, plagiarism and other forms of cheating are substantial. Students are referred to the 2022/2023 Undergraduate Calendar for information on this topic. The

Carleton University Academic Integrity Policy can be found online at https://carleton.ca/registrar/academic-integrity/. It is **your responsibility** to know the contents of these policies, so it is highly recommended that you read them.

Wellness resources

At Carleton, one of the aims is to support students in all aspects of life. There are many programs and service available to promote positive mental health and assist students. A full referral list can be found at https://carleton.ca/studentsupport/supporting-our-students/. If need be, please feel welcome to discuss these resources with your Lab Coordinator, and an appropriate resource will be contacted.

Teaching and Learning Services

Teaching and Learning Services (TLS) can assist you in all facets of teaching and learning, from providing teaching skills and strategies, to helping with blended and online courses, to offering media production services, learning space design, award and grant application support, and more. TLS also engages undergraduate students as partners in teaching innovation and research through Carleton's Discovery Centre. Whether you have a simple question about technology or need in-depth support on pedagogical issues, TLS is here to support you. Fill out this form to set up a one-on-one consultation or email us at tls@carleton.ca.

Class Transition Time

Please respect the start and end times of courses in order to ensure a smooth transition between classes. In general, course instructors have five minutes to set up their course materials before they begin teaching and five minutes to wrap up their course materials before the next class commences.