Syllabus: Food Microbiology Laboratory
NFSC-434 – Spring, 2018
Tuesday and Thursday
12:30 – 4:00 PM
Marie Mount Hall – Room 3419

All information related to NFSC-434 including announcements, laboratory protocols, and shared laboratory results, and related information will be posted on Canvas (https://myelms.umd.edu/login/)

Course Description:

NFSC-434 is intended to provide upper level undergraduate students or incoming graduate students, who have not previously taken an experimental food microbiology course, with the knowledge and skills needed to function effectively in a food microbiology laboratory. The course focuses on demonstrating the principles underlying food microbiology through a discovery process that involves activities that a food microbiologist likely encounter in "real-life" settings. This includes laboratory experiments in the microbial ecology of foods, food spoilage, fermentation processes for food production, food preservation, and food safety. The course, in part, has been designed based on discussions with industry, private, and government laboratory directors in regard to training and skills with which they would like to see their new employees familiar. Practical problem solving is emphasized and written reports are required. While NFSC-434 is a "stand-alone" course, it is designed to be taken in conjunction with NFSC-430, "Food Microbiology." **Students who are not simultaneously enrolled in or have previously taken NFSC-430 should contact Dr. Buchanan on or before first day of class.** NSFC-434 does have a prerequisite of at least one semester of a "general microbiology" course that included a laboratory, such as BSCI-223. The current course assumes that students are familiar with routine microbiological techniques such as simple microscopy, Gram stains, serial dilutions, spread plating, pour plating, etc.

Course Objective:

Demonstrate the principles affecting the growth, survival, inactivation, detection, enumeration, and control of microorganisms in foods while simultaneously introducing students to standard laboratory techniques and practices in food microbiology. A focus of the course is to introduce students to the skills and knowledge needed to work in a food microbiology laboratory either in industry, government, or graduate school.

Instructor:

Robert L. Buchanan, Professor
Room 3306, Marie Mount Hall
301-405-8977
rbuchana@umd.edu

Office Hours: Dr. Buchanan will meet with individual students or laboratory teams on an 'as-needed' basis. To ensure that adequate time is scheduled, all

meetings should be arranged ahead of time by email. Appointments will be scheduled for 30 minutes unless otherwise arranged ahead of time.

Teaching Assistants:

Andrea Gilbert
Room 3407, Marie Mount Hall
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Abby Gao
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Office hours for the teaching assistants are by appointment. Contact them directly at the email addresses or telephone numbers above or during class.

Course Location:

The NFSC teaching laboratory, Room 3419 Marie Mount Hall, will be the primary site for the course. All students should report to that site at the beginning of each class. In addition we will be using equipment and facilities in other laboratories on the third floor of Marie Mount Hall, particularly Dr. Buchanan's laboratory in 3100 MMH. There will be certain restrictions about what materials can be used in the different facilities. Please follow these restrictions carefully, particularly food preparation laboratories where viable pathogens cannot be used.

Student Evaluation:

Course Assignments

Assignments	Points
Lab reports (40p. each lab)	600
Final/Unknowns report	100
Materials Preparation	70
Class participation	70
TOTAL	840

Grading scale (total points/840 X 100%)

A+ (97-100%); A (93-96%); A- (90-92%);
B+ (87-89%); B (83-86%); B- (80-82%);
C+ (77-79%); C (73-76%); C- (70-72%);
D+ (67-69%); D (63-66%); D- (60-62%);
F (<60%)

Student Participation and Materials Preparation Requirements

As part of our effort to provide students with a meaningful experience that allows them to work in or with a food microbiology laboratory, we consider it critical that students understand how the supplies and materials are prepared and subsequently safely disposed of afterwards. To ensure that students have this experience and to avoid charging a laboratory fee for the course, each student will be required to assist in the preparation of

laboratory materials for a total of 10 hours over the course of the semester. A sign-up sheet will be available in the laboratory during the first week of class. Successful completion of this requirement will be considered in the student's overall evaluation (see above).

Most experiments conducted in this course are designed to be done by teams of 3-4 students. It is critical that all students actively and fully participate in their teams to optimize their learning experience and fully "discover" the concepts underlying the experiments. This will require that the groups take the time to plan their assignments, share both the work and the generated data/observations, and keep each other fully informed of events and observations that took place during the conduct of the experiment. It is important that each student reads and understands the experiment **before** coming to class. This will greatly facilitate each group's ability to complete their work in a timely manner. Many of the protocols used in microbiology laboratories are critically dependent on actions being taken at specified times. It is equally important that the teams do not try to rush through the experiments to get done as quickly as possible. Experience has taught the staff that the groups who are too focused on "getting done" are the groups most likely to make major procedural errors. The need to observe, ensure techniques are accurate, document results, and understand what you are seeing are critical to your success. The instructor and the teaching assistants will be evaluating each of the students for their class participation in each class. That participation will be reflected in the participation points awarded (see above).

As with all laboratory courses, attendance is required and absences should be avoided. Students are responsible for informing at least one of the TAs and their laboratory team members in advance of intended absences or missed lab reports due to religious observances or medical appointments. Notice should be provided as soon as possible so that alternative arrangements can be made. It is the student's responsibility to get class notes from one of their laboratory team members or one of the teaching assistants if a lab period is missed.

There will be some experiments that will require observations or activities to be completed during non-classroom periods. Each group will need to plan and designate one or more of their members to complete the needed activities. This includes arranging with one of the teaching assistants to open up the laboratory and be available for questions or emergencies. None of the experiments will involve students needing to be present during the weekend.

Some of the experiments require that the results generated be shared among all the laboratory groups. In such experiments, one of the teaching assistants will be designated to collect the groups' data and post the results on "Canvas" so that it is available to all members of the class. Timely submission of your data and observations to the designated teaching assistant are critical and will be included in your performance for those experiments. Keeping adequate notes are critical to such "whole class" experiments.

A number of experiments will span extended periods of time. For example, the first experiment that you will start in the class is one that spans almost the entire semester. Documenting protocols, observations and data are critical for successful completion of these extended experiments and subsequent preparation of the lab reports.

Tentative Schedule of Experiments:

The procedure for each of the experiments below will be posted on "Canvas" at least one week prior to the scheduled start of the experiment. Students should check "Canvas" at least once per week for announcements related to changes in schedules, modifications to experimental protocols, etc. The schedule of experiments listed below may be modified to address weather closures or issues related to the availability of specialized equipment or supplies.

Week	Date	Lab #	Title	Report Due
1	25Jan2018	1	Experiment #1: "Survival of Pathogenic Bacteria in Dried Foods."	Exp #1: 26Apr2017
2	30Jan2018	2	Experiment #2: "Detecting and Enumerating Microorganisms I: Selective and Differential Media	Exp #2: 13Feb2017
	1Feb2018	3 2	Experiment #3 "Food Fermentations I: Wine Production." -Complete Experiment #2	Exp #3 1May2017
3	6Feb2018	4	-Experiment #4: "Detecting and Enumerating Microorganisms II: Relative Sensitivity of Different Detection Systems"	Exp #4: 22Feb2017
	8Feb2018	5 1	Experiment #5: "Food Fermentation II: Production of Pickles" -Take sample for Experiment #1	Exp #5 29 Mar2017
4	13Feb2018	6	Experiment #6: "Detecting and Enumerating Microorganisms III: Effect of Injury"	Exp #6 6Mar2017
	15Feb2018	3 5 6	-Transfer of materials for Experiment #3 -Take sample for Experiment #5 -Complete Experiment #6	
5	20Feb2018	8	Experiment #7: "Food Spoilage I: Fresh-cut Produce"	Exp #7 27Mar2017
	22Feb2018	1 3	-Experiment #1: Take sample -Experiment #3: Transfer new wine to initial bottles	

		8	-Observations for Experiment #7	
6	27Feb2018	9 8	Experiment #8: Food Spoilage II: Meat, Poultry, and Seafood" -Observations of Experiment #7	Exp #8 27Mar2017
	1Mar2018	9 5 7 8	Experiment #9: "Antimicrobial Properties of Common Spices and Herbs" -Sample Experiment #5 -Complete Experiment #7 -Observations of Experiment #8	Exp #9 15Mar2017
7	6Mar2018	9 9 10	Experiment #10: "Thermal Inactivation of Microorganisms" -Observations for Experiment #8 -Complete Experiment #9	Exp #10 15Mar2017
	8Mar2018	12 1 9 10	Experiment #12: Differentiating Fungi Associated with Foods -Take sample for Experiment #1 -Complete Experiment #8 -Complete Experiment #10	Exp #12 24Apr2017
8	13Mar2018	11	Experiment #11: Bacterial Stress Responses: Induction of Acid Resistance" -Experiment #12 Observations	Exp #11 5Apr2017
	15Mar2018		Complete Experiment #5 Complete Experiment #11	
9	20Mar2018		No Class: Spring Break	
	22Mar2018		No Class – Spring Break	
10	27Mar2018	13 12	Experiment #13: Food Safety I: Effect of Salt Concentration on the Growth Kinetics of Foodborne Pathogens -Continue Experiment #12	Exp #13 17Apr2017
	29Mar2018	1 12 13	--Take sample for Experiment#1 -Continue Experiment #12 -Take sample for Experiment #13	

11	3Apr2018	14 12 13	Experiment #14: Food Safety II: Detection and Identification of *Salmonella enterica* in Foods -Complete Experiment #12 -Complete Experiment #13	Exp #14 19Apr2017
	5Apr2018	12 14	-Continue Experiment #12 -Continue Experiment #14	
12	10Apr2018	15 12 14	Experiment #15: Food Safety III: Humans as a reservoir for enterotoxigenic *Staphylococcus aureus* -Complete Experiment #12: -Continue Experiment #14	Exp #15 24Apr2017
	12Apr2018	1 14 15 16	-Complete Experiment #1 -Complete Experiment #14 -Complete Experiment #15	
13	17Apr2018	16	Experiment #16: Identification of Unknowns	Exp #16. Presentation and Team Report 10May 2017
	19Apr2018	3 16	-Complete Experiment #3 -Continue Experiment #16	
14	24Apr2018	17	Experiment 17 – *In Silico* Evaluation of the Dose-Response Relationships of *Listeria monocytogenes* -Continue Experiment #16	
	26Apr2018	16	-Continue Experiment #16	
15	1May2018	16	-Continue Experiment #16	
	3May2018	16	-Continue Experiment #16	
16	8May2018	16	Continue Experiment #16	
	10May2018		Presentation of results of Experiment #16 Laboratory clean-up	

Important notes:

We will be working in lab teams of 3-4 students. If you have specific preferences in lab partners, please arrange yourselves accordingly on the first day of class. After that lab stations will assigned for the rest of the semester. In picking your laboratory team, think

of this as an opportunity to work and interact with new people, something you will be doing professionally for the rest of your life.

All assignments are to be turned in on time, with a **printed copy** of your lab reports being collected in class on the day they are due. The reports should **not** be submitted via e-mail to the teaching assistants. Lab reports submitted after the designated class period will be considered late. 4 points will be deducted for each week the report is late, up to a maximum of 12 points. Reports that are not submitted will receive a grade of 0, which will have a significant impact of your overall grade. A template for laboratory reports will be provided in a separate document that will be posted on "Canvas." All reports are worth 40 points except the Experiment #17 which will serve as your final examination and is worth 100 points.

We will use "Canvas" to post the instructions for the laboratory, announcements, share laboratory results, and lab report grades. Please be sure that you know how to use "Canvas." If you do not, please contact the OIT help desk at 301-405-1500 for assistance or visit them in the Computer and Space Sciences Building. You can access "Canvas" at https://myelms.umd.edu/login/.

The University has a nationally recognized Honor Code, administered by the Student Honor Council. It is expected that all students are familiar with the Honor Code and adhere to all aspects of the code. Lack of knowledge or understanding of the code is not a justifiable excuse for violating it. Any student involved in an act of academic dishonesty will be reported and will receive a course grade consistent with University policies. The most common problem is plagiarism. If you are unfamiliar with the rules associated with plagiarism, please consult: http://cte.umd.edu/plagiarism-and-honor-code .

The use of cell phones, pagers, headsets, tape recorders, or other electronic devices in the laboratory is prohibited unless otherwise approved by the instructor or the teaching assistants. This is particularly important due to the possibility of electronic devises being inadvertently contaminated. The primary means by which we can decontaminate electronic equipment typically would destroy the cell phone. The instructors and the teaching assistants will ask any student who is inappropriately using electronic devices in the lab to remove them from the laboratory. Since many of the students rely on their cell phones to take pictures of their observations, you may arrange to with TAs to take the picture and then put the cell phone away.

If you have a documented disability and wish to discuss academic accommodations, please talk with the instructor at the beginning of the semester.

All lab instructions should be read prior to entering the lab. Additional materials and supplemental readings may be given during the course of the semester and will be posted on ELMS. Additionally, the teaching assistants will go over any final modifications and instructions at the beginning of each laboratory session.

Laboratory Safety

The laboratory exercises have been designed to provide the students with "real experiences" in food microbiology. The laboratory exercises have been designed to minimize risks; however, there will be instances where the students will be working with

BSL-2 level pathogens, i.e., microorganisms that are capable of causing diseases in humans. It is critical that students follow safety instructions to safeguard yourself, your fellow students and the staff. If there are any questions about safety protocols, please seek clarification before attempting to proceed.

- Lab coats and safety glasses are required at all times when you are in the teaching laboratory (a BL-1 level facility) and in Dr. Buchanan's BL-2 level laboratory. It is the responsibility of each student to purchase their own safety glasses and lab coat. **Students should bring their lab coat and safety glasses with them on the first day of class.** Students should plan on the lab coat remaining in the laboratory for the entire semester. Lab coats cannot leave the labs without being first washed with bleach by the teaching assistants. The reason for this requirement is that during the past decade, the CDC has reported several outbreaks of disease being traced to university science students taking their lab coats home. Please put you name on your lab coat and place in the designated box in MMH 3100 when not in use. Other protective equipment (e.g., gloves) may be required for specific exercises and will be provided when needed. **Please let the instructor or teaching assistants know if you are allergic to latex.**
- Appropriate clothing (long pants or other appropriate attire covering your legs) and shoes (close-toed shoes) must be worn in the laboratory. No shorts or open-toed shoes will be allowed. Loose clothing that could get caught in the laboratory equipment should be avoided or appropriately secured. Ties or loose scarfs should be avoided. Students who arrive to class inappropriately attired will be asked to leave the class until appropriately attired. They will also be debited 5 points in relation to their "class participation" grade.
- Disinfect your bench top before and after each lab session using a diluted bleach solution or 70% ethanol as per instructions from the teaching assistants.
- Wash your hands before and after every lab session, when exiting laboratory, or any time you may have contaminated your hands.
- Mouth pipetting is absolutely prohibited!!!
- Absolutely no food/drink is allowed in the lab!!!
- Hand-to-mouth and hand-to-face contact should be avoided in the lab (this includes indirect contact, such as chewing on your pen or pencil).
- All spills must be immediately disinfected and the teaching assistants informed.
- All contaminated materials should only be discarded in appropriately designated containers.
- We will generally avoid the use of Bunsen burners in the laboratory but for those occasion where their use if necessary, they should never be left unattended and turned off when not in use.
- When transporting materials between laboratories, all contaminated materials should be placed in a transport container that is capable of fully containing the hazardous materials in case of a spill.
- As space is limited, avoid extraneous clothing, books, and papers in the lab. A table will be provided where coats and books can be left during the class.
- Since a number of the experiments require the laboratory teams to share equipment, a number of experiments will be staggered to minimize backlogs in equipment use, which can adversely affect experimental results.
- Report all accidents to the instructor/teaching assistants immediately.

Cleanup Procedures:

- Dispose of used pipettes, plastic ware, and other contaminated materials in the designated large jar or beaker containing disinfectant on your bench.
- Discard all used culture plates in the plastic-lined "burn box."
- To discard, place used microscope slides in the glass dish on each bench.
- All glassware (beakers, bottles, flask, tubes, etc.) and other contaminated glassware should be placed on the designated plastic tray on the laboratory cart.
- Return all equipment and supplies to their proper location. Disinfect and wipe the bench top before you leave.

References:

A copy of the "Difco/BBL Manual," which describes the various media used in food and clinical microbiology, will be posted on "ELMS." Some potentially useful on-line references and guidelines for work in a food microbiology laboratory are provided below. Additional reference materials and supplemental readings will be provided via ELMS as the need arises. Below are several useful online references of methods for working in a food microbiology.

CDC & NIH. 2009. Biosafety in Microbiological and Biomedical Laboratories, 5th edition. http://www.cdc.gov/biosafety/publications/bmbl5/BMBL.pdf.

FDA. 2001. Bacteriological Analytical Manual. http://www.fda.gov/Food/ScienceResearch/LaboratoryMethods/BacteriologicalAnalyticalManualBAM/default.htm.

USDA/FSIS. 2011. Microbiology Laboratory Guidebook. http://www.fsis.usda.gov/science/microbiological_lab_guidebook/.

Health Canada. 2009. Official Methods for the Microbiological Analysis of Foods. http://www.hc-sc.gc.ca/fn-an/res-rech/analy-meth/microbio/volume1/index-eng.php.

Two software packages that are available free of charge from the USDA/ARS are recommended and will be referred to in a number of the planned experiments.

1. Pathogen Modeling Program: An online version is available at (http://pmp.errc.ars.usda.gov/PMPOnline.aspx#nogo) and a stand-alone version (PMP-8) is available at (http://www.ars.usda.gov/services/software/software.htm). This software provides students with the means of understanding the interactions between factors affecting microbial growth, survival, and inactivation.
2. Integrated Pathogen Modeling Program: Available at (http://www.ars.usda.gov/Main/docs.htm?docid=23355) . This provides students with a means of fitting microbiological data to different growth, inactivation, and survivor curves.