FIRE: THE FIRST-YEAR
INNOVATION & RESEARCH
EXPERIENCE

FIRE 152 – Environmental Pathogens Research Stream

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Course Description

FIRE152 is the second-semester First-Year Research & Innovation Experience (FIRE) course for students enrolling in the Environmental Pathogens (EP) FIRE stream. The FIRE152 experience is designed to engage and immerse students in authentic research and scholarship. This course will focus on the concepts related to the process of independent research, including: collaboration with peers, communication of ideas, troubleshooting unexpected outcomes, and discipline-specific methodologies. Scheduled class meetings will focus on the discussion of primary literature, troubleshooting research issues, and continual review research progress. Research sessions in the lab setting will focus on training in current discipline-specific methods and practices, giving students relevant experiences that seek to build resiliency and critical analysis skills. The course requires each student to commit 6 additional hours of independent research per week.

A variety of pathogenic organisms that can infect humans can be found in water, including bacteria, parasites, and viruses. These organisms pose a serious threat to public health and integrity of the ecosystem. The EP research stream uses molecular biology and genomics to study what types of and the source of pathogenic organisms in local waterways and non-traditional water sources used for agricultural irrigation, with the goals of monitoring potential public health risks and working to safeguard the Chesapeake Bay watershed. Data collected by students will reveal insights into how to properly filter and maintain water supplies used in agriculture to avoid potential contamination of food sources, assessing the threat to public health from utilizing contaminated water resources, and cataloging the microbial contaminants found in local water systems.

Additionally, insights into the sources of pathogen contamination will provide the groundwork for discussing how environmental policy and regulation can be used to better control and monitor pollution. These discussions will help students understand how improving environmental regulations can prevent future contamination, producing a healthier and more sustainable watershed.

Overall, the EP stream provides a unique opportunity to gain valuable hands-on research experience and to see first-hand how STEM fields, public health and environmental policy and issues of sustainability intersect to protect people and the ecosystem in which they live.

Learning Outcomes

This course focuses on the following outcomes:

- Develop research capacities in formulating and refining novel hypotheses
- Develop research capacities in identifying and analyzing appropriate and relevant literature to understand the objectives of the research stream
- Develop research capacities in molecular biology, including methods such as genome extraction from environmental samples and genome amplification via PCR
- Develop research capacities in microbiology, including methods such as bacterial culture and antibiotic resistance assay
- Develop research capacities in genomics, including methods such as DNA sequencing and bioinformatics analysis of sequencing results
- Develop research capacities in analyzing and drawing conclusions from experimental data
- Develop research capacities in professional communication, collaboration, and scientific presentation

Course Organization

Students will work as both individuals and in small groups on projects related to the continually evolving research agenda of the stream. The dedicated research space will be open and available each week from 9:00 am-5:00pm M-F. Each student throughout the semester will work on a number of student and faculty driven projects.

Students will build expertise in the following areas:

1) **Demonstrate a broad understanding of scientific principles and the ways scientists in a particular discipline conduct research.**
2) **Apply quantitative, mathematical analyses to science problems.**
3) **Solve complex problems requiring the application of several scientific concepts.**
4) **Look at complex questions and identify the science and how it impacts and is impacted by political, social, economic, or ethical dimensions.**
5) **Critically evaluate scientific arguments and understand the limits of scientific knowledge.**
6) **Communicate scientific ideas effectively.**

Required Texts

Students will review scientific articles related to the research being conducted, which will be provided through Canvas.

Attendance

Due to the independent nature of research, in addition to scheduled weekly class meetings, students will be required to work in the dedicated stream research setting for a **minimum of 6 hours each week, for a total of 78 hours over the semester**.

Students will be required to sign in and out to ensure that research hours are correctly noted.

University sanctioned absences for scheduled class time will be excused, however, the Research Educator must be notified 24 hours prior to the absence. Additionally, absences due to illness require a medical excuse.

Evaluation

Evaluation of student progress will be based on participation in discussions and evidence of work rather than research results. In other words, it is about the process, not the findings. Good scientific research is not a linear progression. Therefore, results may not always come out as expected. Assignments will be weighted as indicated below:

#	Assignments	Course Objective	%
1	FIRE Program Survey	The student participates in the FIRE survey at both the beginning and end of the semester	2.5
2	Group Project Preference Survey	The student has considered the different projects available in the lab and has made and informed decisions concerning what project they will work on for the semester	2.5
3	Weekly Meeting Attendance	The student attends and participates during the meetings, contributing to research discussion.	2.5
4	Notebook Check	The student is able to maintain a proper research notebook, including experimental objective, data, results and conclusions, organized and dated appropriately	2.5
5	Literature Analyses	The student is able to discover and analyze the available scientific literature to determine relevant information, and analyze the component parts of the article.	5
6	Policy Review*	The student is able to identify relevant public policy relevant and explain the significance of this policy as relates to the stream's research objective *Broken into 2 parts, written review and The Bay Game	5
7	Informal Progress Reports	The student is able to relate the progress of his/her research verbally to the rest of the class in an informal setting in order to receive feedback and suggestions.	10
8	Methods Practical and Methods Certification	The student is capable of working independently in the lab with a basic understanding of the methods, both practical and theoretical, being utilized for the research project.	10
9	Final Research Poster	The student is able to create a poster to detail their research and data over the course of the semester and can properly present this data to their peers	10
10	Draft Literature Review	The student is capable of discovering, analyzing and summarizing scientific literature that is appropriate and relevant to the research stream	10
11	Final Literature Review	The student is capable of revising and editing a previous document based on instructor feedback and is able to add additional relevant information to the previous report.	20

12	Research Setting Attendance	The student can work independently within the research setting for a require minimum of 8 hours a week (6 hour lab and 2 hour outlab) in order to work toward the goals of his/her research project.	20

Course Schedule

This schedule is subject to change as the semester progresses. Assignments are due **at the start time** of the class period unless otherwise noted.

Week		**Class Topic/Activity**	**Assignment Due**
1	1/23	NO CLASS	
2	1/30	Introduction of the stream and research goals – What are Environmental Pathogens and why do we care?	
3	2/6	Group formation, Biosafety training *BSL2 Certification must be complete before work in the lab can begin	**ASN1**: FIRE Program Survey (online, as individuals**)** **ASN2:** Group preference (as individuals, online) **ASN3:** Literature Analysis #1 (as individuals, online – **Friday 2/10**)
4	2/13	Literature discussion #1 – Introduction and Methods	
5	2/20	Introduction to Methods – Water collection, DNA extraction, and working with bacteria	**ASN4:** Basic method certification (as individuals, in lab) **ASN5:** Literature Analysis #2 (as individuals, online – **Friday 2/24**)
6	2/27	Literature discussion #2 - Results	
7	3/6	Introduction to Methods – Molecular Biology: PCR and DNA sequencing	**ASN6*:** Methods Practical (as individual, online and in lab)
8	3/13	Literature discussion #3 – Discussion	**ASN7:** Literature Analysis #3 (as individuals, online – **Friday 3/10)** **ASN8:** Mid-semester lab attendance (as individuals)
9	3/20	**SPRING BREAK – NO CLASS**	
10	3/27	Introduction to scientific writing	

11	4/3	Data analysis, using statistics, determining relevance	**ASN9:** Literature Review draft (as individual, online)
12	4/10	Introduction to scientific presentation – basics of presentation skills, presentation formatting, and speaking to the proper audience	
13	4/17	Linking data to real-world application – implications of the findings of the stream 1) Public health risk factors 2) Environmental impacts 3) How to manage and/or prevent future contamination	**ASN10, partI:** Policy Review (as groups, online)
14	4/24	Analysis of current pollution standards and policy related to local watershed systems	**ASN10, partII:** The Bay Game
15	5/1	Poster session	**ASN11:** Poster Presentation (as groups, in class) **ASN12:** Final Research Poster (as groups, online)
16	5/8	Discussion of future directions and expectations next semester; Lab clean up	**ASN13:** Final Literature Review (Individual, online)
	5/15	**NO CLASS (FINAL EXAMINATIONS)**	
End of Course			**ASN14:** Notebook checks (3x during semester, as individuals) **ASN15:** Meeting attendance (all semester, as individuals) **ASN16:** End of semester lab attendance (as individuals) **ASN17:** FIRE Program Survey (online, as individuals)

*Assignment must be completed by this date, but can be turned in at any point prior to this time.

Research Setting Policies

The following policies are strictly enforced within the research setting.

- No eating or drinking in the research setting, including gum or candy. All food and drink must be kept in away from the research area.
- All safety procedures and clothing requirements must be strictly adhered to.
- All efforts to troubleshoot should be made amongst fellow group members and the class as a whole before the instructor becomes involved.
- Students may not work alone in the laboratory setting.

Lab Hours

Hours when the lab is open will be posted at the beginning of the semester. Students are not permitted to be alone in the lab and may only engage in independent work during open lab hours under the supervision of the instructor or a peer mentor.

Class Cancellations and Emergencies

All assignments are due before the beginning of the weekly meeting and are submitted online, therefore assignments will still be due even in the event of a university cancellation. In the event of an emergency, follow all UMD announcements, guidelines and policies. Class will not be held when the university is closed due to emergency, weather or other unforeseen event. Any other cancellations will be communicated through the course website.

Academic Integrity

The University of Maryland, College Park Code of Academic Integrity is strictly enforced in this class. Assignments and classwork must reflect your own, original work and must including proper citation and attribution for work that is not your own. Academic dishonestly includes:

- "Cheating: Intentionally using or attempting to use unauthorized materials, information or study aids in any academic exercise.
- Fabrication: Intentional and unauthorized falsification or invention of any information or citation in an academic exercise
- Facilitating academic dishonesty: Intentionally or knowingly helping or attempting to help another to violate any provision of this Code
- Plagiarism: Intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise."

For information concerning the Code of Academic Integrity see:

http://www.shc.umd.edu/SHC/Default.aspx

Academic Accommodations

If you require academic accommodation, please provide proper documentation by the second class period and contact Disability Support Services so that we can arrange an appropriate accommodation for your needs.

DSS Phone: (301) 314-7682
DSS Web: http://www.counseling.umd.edu/DSS/