MCB4271L Antimicrobial Resistance Laboratory   1 credit

Course Description

UF Catalog: This course-based undergraduate research experience (CURE)-like laboratory covers content related to antimicrobial resistance: the origins of antimicrobial resistance, surveillance, dissemination, mechanisms, therapeutics, and impact on healthcare, agriculture, and the environment.

Course Importance: Cells are living factories capable of adapting their production line to any environmental changes. Hence, cells encountering a toxic environment will evolve their machinery to maintain survival and replication. Such adaptation, called Antimicrobial Resistance, is commonly observed across bacteria, viruses, parasites, and fungi. However, the overuse of antimicrobial agents only recently created a high selection pressure to drive a wide spread of resistance. While we are currently witnessing a constant increase of antimicrobial resistance, the development of novel treatments has almost completely ceased. This course will provide an extensive background on antimicrobial resistance, surveillance, treatment, and mechanisms of resistance. Finally, this course is designed to engage students in experiments that can potentially lead to publishable results.

Time and Location

Time: October 08, 2024 – December 5, 2024; Tuesdays and Thursdays, 3:00 – 6:00 PM
Location: Microbiology & Cell Science Building, Lab 1020

Instructor

Dr. Daniel Czyz (*chysh*)
Department of Microbiology and Cell Science
1355 Museum Drive
Office: Room 1004, Building 981
Phone: 352-392-0237
Email: dczyz@ufl.edu
Twitter: @360Science
Slack: AMR-UF, the app can be downloaded on a desktop, Android, or iOS

Teaching Assistant

Garrett Ellward
Department of Microbiology and Cell Science
1355 Museum Drive
Laboratory 1133, Building 981
Email: glee.ellward@ufl.edu

Office hours: TBD
To request an office hours appointment, send an e-mail directly to the instructor with three suggested dates/times.

Instructor's Teaching Philosophy

"*Your work is going to fill a large part of your life, and the only way to be truly satisfied is to do what you believe is great work*" - Steve Jobs

You embrace education, devote your time to pursue your goals, strive for success, and do your best, but sometimes you are just hitting obstacles that prevent you from moving forward. That's when you wish you had a good mentor. I've helped people who hit obstacles get right back on track, but more importantly, I help my mentees and students avoid hitting obstacles in the first place. I always ensure I am available for my students and colleagues, whether in a classroom or a laboratory setting. As a scientist, I put a lot of time and emphasis on my trainees, providing them with the right personalized support plan to guide them toward their short and long-term goals, as their success is my success. As an educator, my primary objectives are to retain students' attention, promote creativity and teamwork, and encourage out-of-classroom learning.

I find science to be the most fascinating and exciting subject to teach, mainly because it is never fully explored and with the ongoing new discoveries, teaching becomes learning. Science can be found in our everyday life and I believe that relating new information to practical application in daily lives focuses students' attention and enhances learning. For that reason, I link my lecture material to everyday applications as much as possible.

I encourage and expect students to employ out-of-textbook material, including public databases, online tools, and primary literature. While independent projects are important, single-person projects are nearly nonexistent in science. I strongly believe that assigning students to group projects strengthens their team-building core, helps develop essential communication skills, exposes students to conflicts, and teaches them how to deal with them. Most importantly, an assignment might seem difficult for an individual student but becomes trivial when done as a team.

Finally, I put emphasis on mentorship and participation in extracurricular activities. My students are expected to mentor each other because it will help them develop essential skills in their future careers. It's never too early to become a mentor. Finally, I genuinely believe that building a career is not solely attained during classroom education. Participation in community outreach events, conferences, seminars, and symposia is just as important as classroom-based learning. These extracurricular activities build leadership and improve communication skills, and I strongly encourage my students to participate in such activities.

Course Level & Prerequisites

The course requires students to have the following prerequisites: Either MCB2000, MCB3020, or MCB3023 in addition to laboratory sections: MCB3020L or MCB3023L. Important concepts will be briefly reviewed to provide students with a better understanding of the subject. MCB4271 AMR lecture must be taken concurrently with this laboratory section.

Course Objectives

After completion of this course, students should be able to:

- Outline problems associated with antimicrobial resistance across healthcare, agriculture, and the environment
- Describe known mechanisms of antibiotic resistance and modes of transmission
- Identify major classes of antibiotics and their respective mechanisms of action
- Recognize scientific terms related to antimicrobial resistance
- Identify means of detection/assessment of antibiotic resistance
- Describe therapeutic approaches used to fight antibiotic resistance
- Employ various microbiology methods to assess the efficacy of antibiotics

- Generate professional laboratory reports
- Manage and analyze a large amount of genomic data
- Translate laboratory results into clinical applications
- Employ online databases to utilize genomic, chemical, and epidemiological data on AMR

Learning Assessment

Grades are used to assess your learning progress. The vast extent of the information covered by this course should not discourage students. This course is designed to teach you and not fail you. If you encounter any learning difficulties that will affect your grades/learning progress, contact the professor as soon as possible.

GRADING SCALE (total: 1000 pts)

LAB REPORT (250 pts)
The final lab report will need to be completed based on the format specified by the professor.

EXAM (200 pts):
There will be one take-home midterm exam that will assess students' understanding of the course material. The exam will be available on Canvas. Please see the "Additional Comments Regarding Academic Integrity" section for more information.

QUIZZES (200 pts):
There will be four quizzes (50 points each, 200 points total). Quizzes will cover laboratory safety, background knowledge of the material covered in class, understanding of the experimental procedures, and any material assigned by the professor. There will be one Extra Credit Quiz during the first week. This will be an introductory quiz that will cover students' understanding of the syllabus and course requirements.

	Percentage	Score range
A	>93.4	>934
A-	93.3-90.0	933-900
B+	89.9-86.6	899-866
B	86.5-83.4	865-834
B-	83.3-80.0	833-800
C+	79.9-76.5	799-765
C	76.4-73.3	764-733
C-	73.2-70.0	732-700
D+	69.9-66.6	699-666
D	66.5-63.3	665-633
D-	63.2-60.0	632-600
E	<60.0	<600

FINAL PRESENTATION (200 pts)
Each student will give a 12-minute presentation that summarizes all of the experiments performed in the course. The format of this assignment may change.

NOTEBOOK (150 pts)
All notebook entries need to be easy to follow and readable. The notebooks will be collected and graded at the end of the semester.

EXTRA CREDIT:
The professor may offer an extra credit written assignment.

For additional information on Grading Policies please visit https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

Laboratory Safety

Students with diagnosed medical conditions that are known to affect the immune system must contact the professor prior to registering for this course.

Microbiology & Cell Science teaching labs are approved by the Institutional Biosafety Committee for Biological Safety Level-2 work. Each student **MUST** complete proper Biological Safety Training prior to the first meeting and obey the following rules when working in the laboratory. A Certificate of training completion has to be submitted to the professor during the first week.

Training:
1. **Biosafety training EHS853**
2. **Bloodborne Pathogen Training EHS850G**
3. **Biomedical waste training EHS851**

Rules:
1. No cell phone usage (unless allowed by the professor), eating, drinking, chewing gum, or applying cosmetics in the laboratory/desk area. **Anyone breaking this rule will be dropped from the course and receive an automatic "incomplete".**
2. The laboratory is registered as a Biological Safety Level-2 space and we will work with potentially pathogenic bacteria. Therefore, masks are required.
3. All cell phones, backpacks, and purses must be placed in a clean designated area away from students' benches.
4. Hands need to be washed when entering and leaving the lab.
5. Students must read and understand the Agent Profile Form for each pathogen(s) – provided by the professor.
6. Students must be familiar with the location of biological and chemical spill kits, emergency showers, eye-wash stations, and fire extinguishers.
7. When working with biological agents:
    a. Proper Personal Protective Equipment must be worn when biological agents are being handled in the lab.
    b. All BSL2 agents should be handled in a Class II Biological Safety Cabinet. The area should be disinfected with a proper disinfecting agent.
    c. Decontaminate the work area with 70% ethanol before and after work.
    d. If the agent is resistant to ethanol, use bleach (10% of commercially available bleach) and follow with a 70% ethanol wipe-down.
    e. If a laboratory procedure requires gloves, use the One Glove Rule to mitigate contamination of common equipment.
8. Report any spills, drips, splatters, or any potential contamination of the laboratory area to the professor *immediately*. Follow proper clean-up procedures.
9. Solid infectious waste generated in BSCs must be kept inside a leak-proof container lined with a red autoclave bag and stored covered until it is inactivated.
10. Liquid infectious waste must be treated in a BSC for 30 minutes with bleach added to a final concentration of 10% (5000ppm hypochlorite) before disposal via the lab sink drain.
11. All reusable materials and labware used inside BSCs should be surface disinfected with a suitable disinfectant allowing for appropriate contact time before removal.
12. Don't rush! Safety first!
13. If in doubt, ask the professor.

Mandatory Personal Protective Equipment

During each in-person lab period, students are required always to wear a lab coat and face mask when working with biological agents. Both will be provided to the student and stored in a personal ziplock bag to be used all semester. Personal masks are acceptable. Face masks are required because you will be working with biological safety level-2 organisms. You also must wear gloves and closed-toed shoes. Wearing long pants or long sweatpants is strongly recommended. Not following these instructions will result in dismissal from class.

Grades and Grade Points

For information on current UF policies for assigning grade points, see
https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/.

Attendance and Make-Up Work

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:
https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/.

Website

Course material can be accessed through Canvas.
https://ufl.instructure.com/

Technical issues related to the course can be addressed to the UF helpdesk
http://helpdesk.ufl.edu, 352-393-4357, helpdesk@ufl.edu

Communication

For questions and issues on assignments and class organization, please check the syllabus first, the announcements, the calendar, and the Course Handout. To seek further help, please communicate with the instructor via **Slack** or email. For questions regarding class and class content, use the Canvas **Discussion Board**.

Discussion Board: Available through Canvas. Postings and answers are monitored by the instructor
Slack: AMR-UF, the app can be downloaded on a desktop, Android, or iOS
Twitter: Follow and share science news related to the course using #AMR_UF

IMPORTANT: Various material covered in this course (including PowerPoint slides) will be available through Canvas. Prior to the first lecture, please familiarize yourself with netiquette (cyber behavior guidelines). See below "Netiquette guide for online courses".

Course Material

Required material: There is no textbook for this course. This course is based on peer-reviewed publications that will be provided by the instructor. The required reading material will be posted under "Assignments" in Canvas. Questions related to information from the required reading/video material will appear on quizzes and exams. Please refer to the "Assignment" section at the end of the syllabus for a list of Assigned Reading.

Recommended reading and other material: Additional reading material, links to videos, and other online resources will be posted under "Files" in Canvas.

Services for Students with Disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation

0001 Reid Hall, 352-392-8565, https://disability.ufl.edu/

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general wellbeing are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

These resources include:

Health & Wellness
- U Matter, We Care: If you or a friend is in distress, please contact umatter@ufl.edu or tel. 352-392-1575 so that a team member can reach out to the student. http://www.umatter.ufl.edu/
- University Counseling and Wellness Center: Provides counseling services to students
  3190 Radio Road. Tel. 352-392-1575. https://counseling.ufl.edu/
    o Counseling Services
    o Groups and Workshops
    o Outreach and Consultation
    o Self-Help Library
    o Wellness Coaching
- Sexual Assault Recovery Services (SARS): Provides services related to sexual violence. Tel. 352-392-5648. http://www.umatter.ufl.edu/sexual_violence
- Student Health Care Center: Student health-related services. Tel. 352-392-1161.
  https://shcc.ufl.edu/
- Gator Career Closet: Serves as a lending closet for students to borrow professional clothing and accessories free of charge. This service is available to all UF students with a valid UF ID. Tel. 352-392-1601. https://career.ufl.edu/careercloset/
- Food Pantry: Offers non-perishable food, toiletries, and fresh vegetables. This service is provided to current students, staff, and faculty at the University of Florida. Gator 1 ID is required, but no proof of need is required.

For emergencies call the _University Police Department_ at 352-392-1111 (or 911).

Academic Resources

E-learning technical support: Tel. 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connection Center, First Floor JWRU: Career assistance and counseling. Tel. 352-392-1601. https://career.ufl.edu/.

Library Support: Various ways to receive assistance with respect to using the libraries or finding resources. Text 813-463-2283 or Tel. 866-281-6309. http://cms.uflib.ufl.edu/ask

Teaching Center, Broward Hall: General study skills and tutoring. Tel. 352-392-2010 or 352-392-6420. http://teachingcenter.ufl.edu/

Writing Studio, 302 Tigert Hall: Help brainstorming, formatting, and writing papers. Tel. 352-846-1138. http://writing.ufl.edu/writing-studio/

Online Course Evaluation Process

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at: https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at: https://gatorevals.aa.ufl.edu/public-results/.

Setting up VPN

To access UF resources and journal articles off-campus, please set up a Virtual Private Network (VPN). VPN allows you to remotely connect to UF services (i.e. library, UF servers). For detailed instructions on how to set up VPN visit: https://it.clas.ufl.edu/kb/category/vpn/

Netiquette guide for online courses

It is important to recognize that the online classroom is in fact a classroom, and certain behaviors are expected when you communicate with both your peers and your instructors.
These guidelines for online behavior and interaction are known as netiquette.
http://teach.ufl.edu/wp-content/uploads/2012/08/NetiquetteGuideforOnlineCourses.pdf

Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity*." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "*On my honor, I have neither given nor received unauthorized aid in doing this assignment*." It is assumed that you will complete

all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code. If you have any questions or concerns, please consult with the instructor. Additional policies on academic integrity can be found in the Orange Book.

Additional comments regarding academic integrity:

Students are encouraged to discuss the course material with each other, help each other understand concepts, study together, and even discuss assessment questions with each other once the quiz window is closed. However, the following is considered academic dishonesty, and I expect that no student will ever do any of the following:

- Have another person complete a quiz/exam in this course
- Copy another student's quiz/exam in this course
- Collaborate with anyone during a quiz/exam in this course
- Manipulate and/or distribute any materials provided in this course for any purpose (including course lecture slides)
- Use any materials provided by a previous student in the course

The result of any infraction will be consistent with university policy - see "Academic Honesty".

Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Microsoft Office 365 Software is free for UF students
All students are required to install MS Office 365 on their personal computers or use university computers with pre-installed software. Microsoft Excel will be frequently used to tabulate, analyze, and graph collected data. To download a free copy of MS Office, please visit:
http://www.it.ufl.edu/gatorcloud/free-office-365-downloads/

Other free software is available at:
http://www.software.ufl.edu/

To check for availability of the media and technical requirements, contact the UF Computing Help Desk at (352)392-HELP(4357).

University of Florida Complaints Policy and Student Complaint Process

The University of Florida and most instructors believe strongly in the ability of students to express concerns regarding their experiences at the University. Most problems, questions and concerns about the course will be resolved by professionally communicating with the instructor. Please try to meet your instructor in person, make an appointment to call, or try to set up a remote meeting through Skype or other media. The University encourages its students who still wish to file a written complaint to submit that complaint directly to the department that manages that policy. For more information visit:

- Residential Course: https://sccr.dso.ufl.edu/policies/student-honor-code-studentconduct-code/.
- Online Course: http://www.distance.ufl.edu/student-complaint-process

Professionalism is a two-way street. Unprofessional behavior of students includes, among other things: lack of communication, blaming other people or external factors, lying, affecting others negatively in a group or in the class, not accepting criticism and not being proactive in solving problems or seeking help. Furthermore, faculty often have family and other obligations to tend to. Over the weekend, replies to your inquiries or questions may be delayed. If a student is lacking professionalism repeatedly, the instructor has the right to file a formal complaint against the student through the Dean of Student office.

Academic Calendar

Students should familiarize themselves with important academic dates and deadlines available at https://catalog.ufl.edu/UGRD/dates-deadlines/

Course Content (Subject to change)

Tentative Schedule for AMR-L

Date	Day	Experiments
October 8	Tuesday	Testing soil isolates for antimicrobial production. Isolation of bacteriophages from water sources.
October 10	Thursday	Silver nanoparticles as antimicrobial treatment. Picking phage plaques.
October 15	Tuesday	Bacterial identification through MALDI-ToF. Phage purification part 1.
October 17	Thursday	Assessing antibiotic sensitivity with Kirby-Bauer. Biofilm assay with silver nanoparticles. Phage purification part 2.
October 22	Tuesday	Horizontal Gene Transfer; Phage purification part 3.
October 24	Thursday	Modified hodge test. Large agar evolution experiment. Phage enrichment and creation of phage stocks.
October 29	Tuesday	*Serratia marcescens* biofilm reduction assay with isolated phages. Assessing phage titer.
October 31	Thursday	Phage antibiotic synergy with tetracycline.
November 5	Tuesday	Bioinformatics.
November 7	Thursday	Bioinformatics.

November 12	Tuesday	Isolation of new antimicrobial producing bacteria from soil.
November 14	Thursday	Testing new soil isolates against gram-positive and gram-negative bacteria.
November 19	Tuesday	Isolation of new inhibitors; MALDI-ToF with new isolates.
November 21	Thursday	Final Presentation/Paper Working Day; Time for Questions
November 26	Tuesday	No Class--Thanksgiving
November 28	Thursday	No Class--Thanksgiving
December 3	Tuesday	Final Presentations (Day 1)
December 5	Thursday	Final Presentations (Day 2)

Recommended Reading (subject to change)
1. Laboratory Safety & Introduction to AMR: The challenge of antimicrobial resistance. Roope et al. 2019
2. One Health Approach: Report to the Secretory-General of the United Nations. IACG. 2019
3. Antibiotic susceptibility testing: *Manual of Antimicrobial Susceptibility Testing. Cavalieri et al. 2005*
4. Antibiotic susceptibility testing: Antimicrobial Susceptibility Testing. Jorgenson & Ferraro 2009
5. Mechanisms or resistance: Origins and Evolution of Antibiotic Resistance. Davies & Davies 2010
6. Mechanisms or resistance: Mechanisms of Antibiotic Resistance. Munita & Arias 2016
7. Transmission of resistance: Mobile Genetic Elements Associated with AMR. Partridge et al. 2018
8. Transmission of resistance: Mobile Genetic Elements Associated with AMR. Partridge et al. 2018
9. Surveillance: Changes in antibiotics resistance in animals. Moore 2019
10. Surveillance: Global trends in AMR in animals in L and M-income countries. Van Boeckel et al. 2019
11. Surveillance: Understanding drivers of ABR genes in High Arctic soil systems. McCann et al. 2019
12. Surveillance: Reducing antimicrobial use in food animals. Van Boeckel et al. 2017
13. Surveillance: Emergence of plasmid-mediated colistin resistance mechanisms. Liu et al. 2015
14. Novel antimicrobial compounds: Platforms for antibiotic discovery. Lewis 2013
15. Novel antimicrobial compounds: A new antibiotic kills pathogens without detectable resistance. Ling et al. 2015
16. Novel antimicrobial compounds: No assigned reading