Syllabus ABE128: Applied Biology for Agricultural and Biological Engineers (3U)

Instructor: Dr. Laurie Leonelli / Professor Leonelli (lbl@illinois.edu)
TA: Carl Gibson (chg2@illinois.edu)
Lecture: MW 10-10:50am, AESB 208
Lab: W/Th 2-5pm, Turner M5
Office hours: by appointment
TA office hours: TBD
Course website: https://canvas.illinois.edu/courses/65049

Principles of biology relevant to agriculture, food, energy, and the environment, including microbiology, biochemistry, genetics, plant and animal systems, and ecosystems. Case studies of engineering applications where these biological principles have been taken into account or leveraged for the purpose of design.

This course aims to provide students with a broad understanding of basic biological concepts and their relevance to practices related to agriculture and/or bio-related industries. The course covers general principles of biology and explores how these principles inform the design and implementation of agricultural and biological system design.

Course objectives:
1. Build a strong biological foundation for problem-solving in scenarios involving living systems
2. Encourage students to connect biological concepts with engineering applications
3. Develop critical thinking and scientific inquiry skills
4. Learn to work productively in a small group setting to accomplish lab activities

ABET learning outcomes:
LO#4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
LO#5: An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
LO#6: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
LO#7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

*********TENTATIVE COURSE SYLLABUS---SUBJECT TO CHANGE**********

Theme of the Week	Dates	Concepts covered	Lab (W/Th)	Assignments
1. Meet the course	W1.21	Course introduction and Expectations	NO LAB	N/A
2. Where does fuel come from and can we make more?	M1.26	Life and its History on Earth; Atoms, Bonds, and Macromolecules	Hydrothermal Liquefaction overview and visit	**Worksheet (10pts**) due by start of next lab section
	W1.28			
3. What makes soils healthy?	M2.2	Biodiversity and Cells; Cellular components and organelles	Winogradsky Columns and build-a-bug (2pt-Prelab QUIZ)	**Worksheet (10pts)** due by start of next lab section
	W2.4			
4. Beer, bread, and biofuels; The making of industries	M2.9	Metabolism and reaction coupling; Anabolism and Catabolism	Fermentation lab (2pt-Prelab QUIZ)	**Structured abstract (10pts)** due by start of next lab section
	W2.11			
5. Genomic playbook: Decoding the instructions of life	M2.16	QUIZ (20pts)	Code makers and breakers (2pt-Prelab QUIZ)	**Worksheet (10pts)** due by start of next lab section
	W2.18	Central Dogma		

6. Catalysts and catch-alls: Proteins and all they do	M2.23 W2.25	Proteins; Enzyme kinetics	Enzyme activity (2pt-Prelab QUIZ)	**Mini-report (20pts)** due by start of next lab section
7. Understanding the dynamics of biological systems	M3.2 W3.4	Gene regulation; Expression; Bioinformatics & genomics	Bioinformatics (2pt-Prelab QUIZ)	**In-lab assessment (10pts)**
8. Revisit, Review, and Reflect; Midterm week	M3.9 W3.11	Review; Designing Questions MIDTERM (40pts)	NO LAB	N/A
9. Have fun, relax, recover	M3.16 W3.18	SPRING BREAK	NO LAB	N/A
10. Synthetic biology and the ethics of genome editing	M3.23 W3.25	GMOs and ethics of Engineering; CRISPR; synthetic biology; plasmids	Ethics discussions and scenarios	**Response paper (10pts)** due by start of next lab section
11. Bioprocess development: How to build biological platforms	M3.30 W4.1	Plasmids; PCR; restriction enzymes; Expression modules; transformation	Copy, cut and paste: PCR and gel electrophoresis (2pt-Prelab QUIZ)	**Worksheet (10pts)** due by start of next lab section
12. How to create organisms for particular environments	M4.6 W4.8	QUIZ (20pts) Mutations; and Directed Evolution	Experimenting with Luria-Delbruck (2pt-Prelab QUIZ)	**Mini-report (20pts)** due by start of next lab section
13. How do breeders improve crop yield?	M4.13 W4.15	Genetics and Breeding; Natural and artificial selection	Problem sets and Probabilities	**Practice sets (20pts)** due by start of next lab section
14. Droning on: The many roles of photosynthesis in plant health	M4.20 W4.22	Photosynthesis; details and derivatives; Light reactions; Carbon fixation	Carbon Cycle activity	**Worksheet (10pts)** due by start of next lab section
15. Fertilizers: How elements move through ecosystems	M4.27 W4.29	Nutrient cycling and Agriculture; Outlooks for the Future	Concept maps and discussion	**Review for Upcoming Final**
16. What have we learned?	M5.4 **W5.6**	Question session & Review **FINAL EXAM (40pts)**	NO LAB	N/A

Grades

Assessments	**Points**
Lab assignments	140
Pre-lab Quizzes	14 (2 pts each)
Quizzes	40 (two in-class quizzes, 20pts each)
Midterm	40
Final-May 6 (in class)	40
TOTAL	**274**

Grades are based on a point system. This semester **anticipate** that you will be able to earn up to **274pts** through lab assignments, critical thinking questions, in-class assessments (quizzes and midterm), and a final exam. **There may be additional opportunities to earn points outside of given assignments based on outstanding performance and participation.** Your final grade will be calculated as a percentage of the points you've earned out of 274. Percentages will be translated as follows:

A…….100-92.5	B……..86.4-82.5	C…….76.4-72.5	D…….66.4-62.5
A-……92.4-89.5	B-…….82.4-79.5	C-……72.4-69.5	D-……62.4-59.5
B+……89.4-86.5	C+……79.4-76.5	D+…..69.4-66.5	F……..<59.4

Late Policy
Assignments must be turned in via the canvas portal on/before the due date unless otherwise indicated by the instructor or TA. Failure to meet the deadline for an assignment will result in a 10% grade reduction for *each day* the assignment is past due, e.g. if you turn in a 10-point assignment 2 days late, the max points you can earn becomes 8/10 points (unless provisions have been made prior to a missed assignment, see Absence Policy & Religious Observances sections below).

Academic Integrity (do NOT cheat, lie, or plagiarize)
The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: http://studentcode.illinois.edu/.

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: https://studentcode.illinois.edu/article1/part4/1-401/. Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

In the case that a cheating incident is thought to have occurred, **the allegation WILL be formally reported to the Faculty Academic Integrity Report (FAIR) portal and the appropriate steps will be followed to resolve the allegation.**

ChatGPT
AI is a very powerful tool for advancing learning opportunities, however, there are appropriate and inappropriate ways to use/abuse AI. For the purposes of this class, you may use ChatGPT to synthesize background information for your own understanding, with the caveat that AI is just like any other internet resource and the reliability of the information you obtain may be questionable. **You may NOT use ChatGPT to prepare materials for written assignments or lab reports. All materials submitted for assessment must be generated from biological brains enrolled in the class, *specifically the brains being evaluated for the assignment.***

Laboratory guidance
There are three lab sections associated with this class. You must attend the section that you are officially enrolled in because 1) there are only so many seats in the lab, and 2) because you will work with the same lab group for the duration of the course. **Attendance is mandatory**; you will have great difficulty making up a field trip or lab experiment. One section will be led by Dr. Leonelli and the other will be led by Carl. In lab, it is important to read materials before attending class to ensure that activities run smoothly. This will be incentivized **by a pre-lab quiz** that will assess whether or not you understand the goals of the activity.

Absence Policy
Students are responsible for attending all classes, taking notes, obtaining other materials provided by the instructor, taking tests, and completing assignments as scheduled by the instructor. ***Requests for submitting assignments after due dates require documentation of events such as illness, family emergency, religious observances, or a university-approved activity.*** (https://odos.illinois.edu/community-of-care/resources/students/absence-letters/). Conflicts with dates on which assignments are scheduled must be discussed with the instructor or TA ***prior to the date of the assignment***. Students must contact the instructor as soon as possible if they anticipate missing multiple classes due to events such as chronic illnesses, travel related to team sports, or other university activities. Students should contact the instructor or TA in advance to determine alternatives that might be available if you have an excused absence.

If you must miss a class due to an illness or other emergency, **please provide the appropriate documentation found here:** (https://odos.illinois.edu/community-of-care/resources/students/absence-letters/).

Mental Health
Significant stress, mood changes, excessive worry, substance/alcohol misuse or interferences in eating or sleep can have an impact on academic performance, social development, and emotional wellbeing. The University of Illinois offers a variety of confidential services including individual and group counseling, crisis intervention, psychiatric services, and specialized screenings which are covered through the Student Health Fee. If you or someone you know experiences any of the above mental health concerns, it is strongly encouraged to contact or visit any of the University's resources provided below. Getting help is a smart and courageous thing to do for yourself and for those who care about you.

- Counseling Center (217) 333-3704
- McKinley Health Center (217) 333-2700
- National Suicide Prevention Lifeline (800) 273-8255
- Rosecrance Crisis Line (217) 359-4141 (available 24/7, 365 days a year)

If you are in immediate danger, call 911.

Family Educational Rights and Privacy Act (FERPA)
Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See https://registrar.illinois.edu/academic-records/ferpa/ for more information on FERPA.

Community of Care
As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regards to their well-being or yours, we encourage you to refer this behavior to the Student Assistance Center (217-333-0050 or http://odos.illinois.edu/community-of-care/referral/). Based on your report, the staff in the Student Assistance Center reaches out to students to make sure they have the support they need to be healthy and safe.

Further, as a Community of Care, we want to support you in your overall wellness. We know that students sometimes face challenges that can impact academic performance (examples include mental health concerns, food insecurity, homelessness, personal emergencies). Should you find that you are managing such a challenge and that it is interfering with your coursework, you are encouraged to contact the Student Assistance Center (SAC) in the Office of the Dean of Students for support and referrals to campus and/or community resources.

Students with Disabilities
To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor as soon as possible and provide the instructor with a Letter of Academic Accommodations from Disability Resources and Educational Services (DRES). To ensure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class should apply for services with DRES and see the instructor as soon as possible. If you need accommodations for any sort of disability, please speak to me after class, or make an appointment to see me or see me during my office hours. DRES provides students with academic accommodations, access, and support services. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 217-333-1970, e-mail disability@illinois.edu or visit the DRES website at http://www.disability.illinois.edu/. Here is the direct link to apply for services at DRES, https://www.disability.illinois.edu/applying-services.

Disruptive Behavior
Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office for Student Conflict Resolution (https://conflictresolution.illinois.edu; conflictresolution@illinois.edu; 333-3680) for disciplinary action.

Emergency Response Recommendations
Emergency response recommendations and campus building floor plans can be found at the following website: https://police.illinois.edu/em/run-hide-fight/. I encourage you to review this website within the first 10 days of class.

Religious Observances
Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices regarding admissions, class attendance, and the scheduling of examinations and work requirements. Students should complete the Request for Accommodation for Religious Observances form should any instructors require an absence letter in order to manage the absence. To best facilitate planning and communication between students and faculty, students should make requests for absence letters as early as possible in the semester in which the request applies.

Sexual Misconduct Reporting Obligation
The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX and Disability Office. In turn, an individual with the Title IX and Disability Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential.

Other information about resources and reporting is available here: wecare.illinois.edu.