

Biomedical Innovation (BI)
Collegiate School of Medicine and Bioscience
2024 – 25 School year Syllabus
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Room 017
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Office hours:
Tuesday 315 p.m. - 5:00 p.m.
Tutoring:
Wednesday during planning time (subject to change)

Coronavirus (COVID-19) Information

Students must be prepared for any, and all, classes to be moved online in response to changes in the coronavirus status. Please visit the [COVID-19 website](#) for the latest update. If you are sick Please stay home I will record the lessons and post them in teams

Biomedical Innovation - Capstone Course and internship

This course of the fourth and final course of the PLTW Biomedical Science sequence, students build on the knowledge and skills gained from previous courses to design innovative solutions for the most pressing health challenges of the 21st century. Students address topics ranging from public health and biomedical engineering to clinical medicine and physiology. They can work on an independent design project with a mentor or advisor from a university, medical facility, or research institution. Students demonstrate their knowledge throughout the course by completing activities, projects, and problems using a variety of assessment tools, such as performance rubrics and reflective questioning, to deepen and expand their knowledge and skills. Additionally, students will be working with a professional mentor through.

All students in this course should be seniors who have completed the entire PLTW sequence PBS, HBS, MI. some exception may be applied. This is a yearlong very fast paced course where the bulk of the work will be completed in the first semester. Note All student are still responsible for completing the work second semester while on internships

All students in this course are required to take the biotechnology assistant credentialing Exam or BACE in April/May

What is BACE?

The Biotechnician Assistant Credentialing Exam (BACE) is an industry-recognized exam designed to assess core skills and knowledge sets identified by industry and represented within the academic and performance standards of biotechnology programs. The exam was originally vetted by the state of Florida's industry organization, BioFlorida, which represents more than 3,000 companies and research organizations in the biotechnology, pharmaceuticals, medical devices, and bio agriculture sectors. Since its creation, BACE has been assessed by national and international companies as other states continue to adopt the exam.

CO-Curricular Opportunity: Students in our biomedical sciences program are highly encouraged to become members of our student organization called HOSA-Future Health Professionals HOSA is

considered to be “co-curricular” to the biomedical program and the class will incorporate lessons and leadership training related to HOSA. Additionally, members in HOSA are eligible to attend and compete at the State and National Leadership Conferences.

Why join HOSA?

Becoming a part of the quickest expanding organization in the fastest growing career field is nothing but beneficial to the students that choose to get involved. HOSA truly is healthcare training for students that have the desire to enter into medicine. Competitive events featured at conferences include knowledge and skills that are sure to be seen again in future education. Offering internships and scholarships, HOSA also gives members the chance to connect to health professionals that they aspire to be like one day. Additionally, leadership and communication skills are vital to success in any career, and HOSA provides just that. With symposiums by prosperous entrepreneurs, professional leadership developers, and eloquent public speakers, HOSA hands you all the tools necessary to be successful in whatever you choose to do.

REFERENCES:

This course was developed by **Project Lead the Way, Inc.** and all materials and information originated from their curriculum development. **NO materials from this course may be posted or shared online. If you post any material online wvou will be subjected to disciplinary**

Required Materials:

In order to be successful in this class, you will need the following materials daily. Please let me know **IMMEDIATELY** if you will have difficulty getting any of the materials and I will find a way to help you get what you need:

- Laboratory Notebook
- 1 inch 3-ring binder
- Dividers
- Notebook Paper (College Ruled preferred)
- Pencils
- Blue or Black Pen
- Colored Pencils
- Graph paper
- Laptop computer (school provided)
- Post it notes

Binders:

Students are required to maintain a 3-ring binder with section dividers for this class. It is my advice to use a separate binder for this class that does not include material from any other classes.

Laboratory Journal:

Additionally, students must have a separate carbon copy notebook to be used only as a lab journal. The lab journal carbon copies will be submitted in a biweekly basis for review and grading purposes.

Additional Materials:

Personal flash drive (this is a must every day), colored pencils, calculator.

Computer Access:

Students will need to be able to access the PLTW Learning Management System (LMS) online for homework and help outside of the classroom. Each student will receive a personalized log on for this

system. Additionally, students will need to access Mentored Pathways in order to communicate with their professional mentor.

Independent Research and Labs/Videos/Job Shadowing:

Students will be responsible for the completion of an independent project capstone/ internship. A student's project might include the need to work with graduate students or professionals in a specialized field and additional supplies or materials. Students must include me (and I suggest parents) in any communications with individuals that are assisting them in research. I will help students in developing their experiment and locating resources, however I cannot guarantee the ability to cover all material costs.

As this is a biomedical class scientific videos might be used as resources and could include Anatomically correct body parts. These videos are used to demonstrate the process of completing autopsies and the cardiovascular system with models.

Tutoring

If a student would like extra help on an assignment or is having difficulty with the current topic, s/he may come in for tutoring after school. Remember it is your responsibility to seek help, I will make myself available to you should you need additional help.

Student Conduct

Students are expected to behave as adults. Behavior that is disruptive to the learning environment will not be tolerated. The following consequences will be implemented.

- First Instance – Verbal reminder *
- Second Instance – Parent/Guardian contact *
- Third Instance – Administrative referral and loss of extra credit points
- Depending on the severity of the behavior, administrative referral may be prior to the third instance.
- Profanity will not be tolerated.
- Absolutely no food or drink (except water) in a closed container

Grades:

It is the student's responsibility to complete and turn in classwork and homework assignments on time.

Late work will need to be submitted within 7 days of its official due date, this does include weekends. The penalty is 20% as per school wide policy.

Semester grades will be calculated as follows:

1. Labs	30%
2. Writing assignments/do now's	10%
4. Test	40%
5. Projects/quizzes	20%
Total	100%

The above formulas as shown will calculate progress grades and termgrades ONLY.

Final semester grades calculation

- **20% Final exam**
- **80% 3rd term grade for first semester or 4th term grade or secondsemester**

Grading Scale

Grade	Scale	Description of Work
A	90-100%	Consistently demonstrates an exceptional level of quality and effort. Having all work in on time and completed to exceed expectations. Mastery in evaluating, synthesizing, and applying the knowledge.
B	80-89%	Consistently demonstrates proficient knowledge with a good effort and quality of work. All assignments are complete and on time. Demonstrates the ability to evaluate, analyze, synthesize and apply the principles.
C	70-79%	Demonstrates proficient knowledge and the ability to apply knowledge. Work shows average effort. A few assignments may be missed or late.
D	60-69%	Work shows minimal effort and some assignments are late. Demonstrates a basic understanding of recalling or comprehending knowledge
F	Below 59%	Understanding is below basic. Work is of poor quality and does not meet standards or expectations.

Attendance/Tardies: Students are expected to attend and be on time for each and every class. The attendance and tardy policies and procedures set forth in the student handbook will be adhered to and upheld. Students will not be able to make-up formal assessments such as tests or presentations that were missed due to an unexcused absence.

Late Work and Make-up work:

Homework, projects, labs, etc. are due at the beginning of class on the assigned day. Late work will be assessed a penalty as outlined in the school policy

Late work will not be accepted if it is due to an unexcused absence. It is your responsibility to retrieve the work you missed, **check teams often**.

Do not interrupt class for make-up work. You may see me before or after school to discuss the assignments. Labs cannot be made up. If you miss a lab, a make-up assignment will be given even if you have an excused absence.

Classroom Expectations:

HAWKS - Honest, Accountable, Welcoming, Knowledgeable, School-Spirited

Be Present:

In order for you to learn, you must be present. The expectation is that you are in the classroom, willing and ready to learn each day. This class is fun but it is also challenging. If you miss class, you will get behind which ultimately causes you more work.

Be Prepared:

Bring your notebook, writing utensils and a good attitude to class.

Respectful and Courteous:

Please remember you are not the only one in class. You are to treat others in a tolerant, considerate, courteous and respectful manner always. This includes using appropriate language, speaking in a mature manner, willingness to work with other members in your group, and participating fully in classroom activities.

Many of the lesson activities in this class require group work. Therefore, participation and getting along with others is a necessary component of the course. If you are having problems within groups please let me know. Failure due to one person in the group not completing their portion is not acceptable. You always have the option to complete an assignment for full credit. I am here to help every one of you succeed. Seek help if you need it, ask questions and treat others respectfully and I guarantee this class is one you will not forget.

COURSE TOPICS

Biomedical innovation course has been designed to allow flexibility in timing and topics. For 2023 - 24 students most complete 5 of the problems as outlined below with Optional Problems 6, 7 and 8. **Aiming to complete unit 8 as capstone project**

Problem 1 – Design of an Effective Emergency Room

Problem 2 – Exploring Human Physiology

Problem 3 – Design of a Medical Innovation

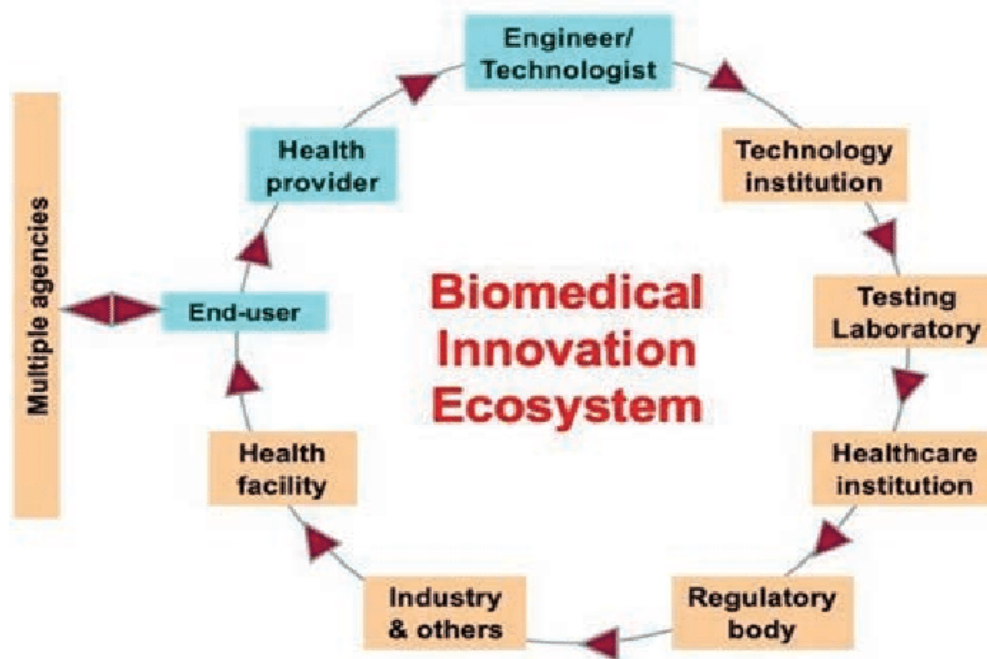
Problem 4 – Investigating Environmental Health

Problem 5 – Combating a Public Health Issue

Problem 6 – Molecular Biology in Action (Optional)

Problem 7 – Forensic Autopsy (Optional)

Problem 8 – Independent Project (capstone)



BACE exam Topics for Knowledge Content Section

GENERAL TOPICS IN BIOTECHNOLOGY

- Discuss current techniques used in biotechnology, and their applications
- Demonstrate knowledge of regulatory agencies governing the manufacture and distribution of biotechnology-derived products
- Outline the development and regulatory approval process of biopharmaceuticals
- Understand the purpose of Good Laboratory Practices (GLPs), Good Clinical Practices (GCPs), and current Good Manufacturing Practices (cGMPs)
- Discuss the role and identify types of documents used in cGMP compliant industries
- Outline the role of various departments in a company, including Research and Development, Quality Assurance, Quality Control, and Manufacturing
- Describe appropriate safety and workplace behaviors
- Outline the manufacturing process of biopharmaceuticals
- Describe Environmental Monitoring in a controlled space
- Discuss ethics and bioethics in the workplace and society
- Describe careers in the biotechnology field
- Describe historical applications, benefits and advances in biotechnology

TECHNICAL SKILLS/APPLICATIONS

- Describe the process of culturing microorganisms and tissues using aseptic technique
- Differentiate between sterilization, decontamination, and disinfection
- Describe the proper use of microscopes
- Understand the principle by which a pH meter works
- Discuss methods of DNA isolation, purification, and quantification
- Contrast agarose gel versus polyacrylamide gel electrophoresis (PAGE)

- Describe how restriction enzymes are used
- Describe recombinant DNA and cloning techniques
- Discuss the transformation and transfection of model organisms
- Describe the mechanism of Polymerase Chain Reaction (PCR)
- Discuss protein expression in model organisms
- Discuss methods of molecule/protein isolation, purification, and quantification
- Understand principles of immunoassays, such as ELISA
- Explain the principles of spectrophotometry
- Demonstrate knowledge of laboratory equipment calibration and validation
- Use scientific notation, significant digits, and decimals correctly

BIOCHEMISTRY/CHEMISTRY

- Compare and contrast types of chemical bonds
- Understand the chemistry of molecules and macromolecules
- Discuss the differences between aerobic and anaerobic respiration
- Demonstrate knowledge of enzymes and reaction rates
- Describe DNA structure and function
- Describe transcription
- Describe protein structure and function
- Describe translation and gene expression

BIOLOGICAL SYSTEMS

- Explain cell theory
- Understand the general physiology of cells
- Explain the interaction between cells, and between cells and their environment
- Describe cell division (meiosis and mitosis)
- Discuss cell staining, and distinguish between Gram positive/negative cells
- Demonstrate an understanding of the immune system
- Understand the genetics of model organisms
- Describe the “central dogma of molecular biology”

WORKPLACE SAFETY & BEHAVIOR

- Identify Safety Symbols
- Exercise proper laboratory safety protocols
- Describe proper handling of biological and hazardous waste
- Identify and properly use Personal Protective Equipment (PPE)
- Derive information from Safety Data Sheets (SDS)
- Follow practices associated with regulatory compliance
- Demonstrate good documentation practices, including following Standard Operating Procedures (SOPs)
- Properly label items, including solutions, buffers, Petri plates, samples, and products
- Identify acceptable work habits

BACE P Exam Topics for Practical section

BIOTECHNOLOGY SKILLS

- Accurately measure liquids using micropipettes and serological pipets
- Accurately measure mass using electronic balances

- Demonstrate proper aseptic/sterile technique
- Demonstrate proper culturing of microorganisms
- Demonstrate proper use of electrophoresis equipment
- Properly measure and adjust the pH of a solution with a pH meter
- Properly prepare solutions, buffers, and media
- Properly perform a serial dilution
- Describe the applications and proper use of a spectrophotometer
- Describe the proper use of a centrifuge
- Use 24-hour time correctly

APPLIED MATHEMATICS IN BIOTECHNOLOGY

- Use scientific notation, significant digits, and decimals correctly
- Perform calculations for serial dilutions
- Perform calculations using dilution ratios
- Make conversions within the metric system, and use metric measurements
- Solution preparation:
 - Solve Volume/Volume (V/V) and Weight/Volume (W/V) solution calculations
 - Solve Molarity solution calculations
 - Solve Dilution Factor calculations
- Generate a graph using collected data:
 - Apply Beer's Law
 - Generate a standard curve
 - Properly plot data
 - Interpret data

LABORATORY EQUIPMENT

- Identify laboratory glassware and equipment
- Demonstrate proper and safe use of equipment (including, but not limited to):
 - Fume hoods
 - pH Meters
 - Biosafety cabinets
 - Incubators
 - Microscopes
 - Centrifuges
 - Electrophoresis equipment
 - Water Baths
 - Spectrophotometers
 - Stirrers/Shakers
 - Micropipets & serological pipets
 - Vortexers
 - Electronic balances
 - Autoclaves

RESEARCH & SCIENTIFIC METHOD

- Discuss good experimental design, including the proper use of controls
- Explain the scientific method
- Analyze and interpret data, including the use of statistical analysis
- Explain how to maintain a laboratory notebook
- Discuss various ways of communicating scientific research, including peer-reviewed journals, and presenting posters or talks at meetings