BIO 5330
PRINCIPLES AND APPLICATIONS OF BIOTECHNOLOGY I
FALL 2018

Time: M W F 11:30 a.m. – 12:20 p.m.

Place: 0111 Main

Instructor: Dr. Penelope I. Higgs
4115 Biological Sciences Bldg.
pihiggs@wayne.edu
313 577-9241

Office hours: by email appointment

Reading:

- Chapters from Microbiology texts (provided)
- web sites from specific vendors (because this replicates a method commonly used while working in a lab (I am just picking the best information sites and NOT endorsing a particular vendor)
- Papers from the literature
- The Physiology and Biochemistry of Prokaryotes, D. White, 3rd edition. Oxford University Press. New York 2007. This text is available free online at: http://app.knovel.com/web/toc.v/cid:kpPBPE0001/viewerType:toc/root_slug:physiology-biochemistry/url_slug:physiology-biochemistry/?
- Molecular Biology, D.P. Clark and N.J. Pazernik, 2nd edition. AP Cell Press. 2013.
- Molecular Genetics of Bacteria, L. Snyder and W. Champness, 3rd edition. ASM Press, Washington D.C. 2007. This text is available free at WSU libraries.

It is not necessary to purchase these texts.

Overview:

This course will provide an introduction to the principles and methodologies of modern molecular biology and biotechnology with an emphasis on molecular biology methods used in a typical research program. *It is not just techniques*. It is the principals underlying techniques so you can ultimately apply them with flexibility in your future career.

The class will be divided into three different sections: 1) Bacterial physiology - metabolism, growth, and gene expression; 2) Cloning - the enzymes and vectors of cloning, as well as PCR and primer design; and 3) Recombinant protein expression and purification, and analysis of proteins and antibodies

Learning objectives:

1) describe the basic physiology, biochemistry, and molecular genetics of microorganisms (esp. bacteria) as pertains to biotechnology, and infer growth characteristics from actual data.
2) identify the properties (structure and function) of the enzymes and reagents used in classic recombinant DNA and PCR methods.
3) design several DNA constructs “in silico” (or on paper) using established methods and flow charts delineating the proper series of events
4) compare and contrast different methods used during cloning and troubleshoot potential outcomes.
5) describe how recombinant proteins are expressed in and purified from E. coli and how to troubleshoot insoluble protein production
6) delineate and compare several techniques underlying the detection and analysis of protein-protein interactions including pull-downs, cross-linking and phage display
7) describe production and uses of antibodies and their use in biological questions/biotechnology

These points will be organized into three different sections: 1) Bacterial physiology - metabolism, growth, and gene expression; 2) Cloning - the enzymes and vectors of cloning, as well as PCR and primer design; and 3) Recombinant protein expression and purification, and analysis of proteins and antibodies

The format of the class will be active learning through reading and class discussion, not through traditional lectures. Reading for each topic will be taken from book chapters and published papers. Classes will be devoted to analyzing the assigned readings. Students are expected to read assignments before class, and to be prepared to discuss the material from each assigned reading. Class participation will be a component of the course grade. Classes are not recorded. Therefore, **attendance is mandatory**. Do not book non-essential appointments (including interviews) during class period.

What is expected from students: *You MUST come to each class fully prepared to engage in the material.* This actually means that you read and STUDY the material ahead of each class so that you can engage in a conversation about the material. The conversation will also be directed using classroom worksheets that will be difficult to complete if you do not come ready to work. I will try to focus your reading by reading guides, but you must learn to identify relevant information in texts. As the semester progresses, you should improve your reading/studying skills and more readily ascertain the key elements and basic principles. It is not simply a memorize and regurgitate exercise. You will learn how to integrate these ideas you find in you reading into working models of recombinant methods. This, then mimics real life.

Effective reading: Start early and give yourself LOTS of time. Information will come from many different sources (just like in the real world) so it may seem like a burden. Do some reading every day. You will see the redundancy in information and extraneous material you can bypass. Guide questions help you determine what to focus on, but due to the varied background of students in this class, much of the material you perceive as "extra" will actually be very helpful in understanding all of the concepts. As you read, critically evaluate the information and place the information into a model of how things seems to be working, and/or exactly what is happening in the test tube when a reagent is used. Look up the details. Just as importantly, identify what you don't understand. Raise the issues in class- it is the misunderstandings that we want highlighted and fixed.

Tests and grading:

The course grade will be calculated based on three exams (100 points each) and class participation, quizzes (potentially including unannounced quizzes), and assignments (200 points) for a total of 500 points. The exam dates are:

Exam 1: Monday, October 1st
Exam 2: Friday, November 9th
Final Exam: **Monday, December 17 at 10:15 am (tentative: final decision after discussion with class)**

Closed book exams within the classroom setting will mimic much of what you did as classroom activities. They will likely include sort answers, drawings, problem solving, application and critical thinking questions. Exams MAY include take-home portions which will be more involved problems requiring access to reading and on-line material, and may include summarization of selected portions of the reading material. **You are honor-bound to do the take-home component *on your own*.**

There will be no make-up exams except for medical emergencies, which must be documented by a physician. A make-up exam may be in a completely different format from the class exam. Students will have one week after the return of an exam to challenge a given question. A challenge will consist of a typed description of why your answer should be considered correct based on other published material that you cite.

Participation, daily work and assignments:

In-class and homework assignments are a major part of this class. Participation in group discussions is essential (asking questions counts too). Homework and corresponding due date will be announced in class and are due at the beginning of class. Assignments often include answering questions, drawing, graphing and/or working on a computer (which you will need to bring with you). Various portions of in-class assignments and homework will be handed in for grading. There is very little (to no) option to make up in class assignments that you miss- *so come to class.*

Grade calculation:	**Exam 1:**	**100 pts**
	Exam 2:	**100 pts**
	Exam 3:	**100 pts**
	Quizzes, Assignments, Homework:	**200 pts**
	TOTAL:	**500 pts**

Your final grade will be determined by assessing the absolute and relative performance of each student based on the total points earned in the course.

Lecture Schedule:
Tentative lecture schedules will be provided for each section. Given class dynamics, the content may change. Exam dates will NOT change so we will use classroom announcements to ensure you know what is covered in each exam. You can also monitor your progress based on performance in class and homework assignments/small quizzes.

Religious holidays (from the online Academic Calendar):

Because of the extraordinary variety of religious affiliations of the University student body and staff, the Academic Calendar makes no provisions for religious holidays. However, it is University policy to respect the faith and religious obligations of the individual. Students with classes or examinations that conflict with their religious observances are expected to notify their instructors well in advance so that mutually agreeable alternatives may be worked out.

Student Disabilities Services:
If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. The SDS telephone number is 313-577-1851 or 313-202-4216 for videophone use. Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University. You can learn more about the disability office at www.studentdisability.wayne.edu
To register with Student Disability Services, complete the online registration form at:
https://wayne-accommodate.symplicity.com/public_accommodation/

Counseling and Psychological Services (CAPS):
It is quite common for college students to experience mental health challenges, such as stress, anxiety and depression, that interfere with academic performance and negatively impact daily life. Help is available for any currently enrolled WSU student who is struggling with a mental health difficulty, at WSU Counseling and Psychological Services (caps.wayne.edu; 313 577-3398). Other options, for students and nonstudents, include the Counseling and Testing Center, and the Counseling Psychology Training Clinic, in the WSU College of Education (coe.wayne.edu/tbf/counseling/center-index.php). Services at all three clinics are free and confidential. Remember that *getting help, before stress reaches a crisis point, is a smart and courageous thing to do* – for yourself, and for those you care about. Also, know that the WSU Police Department (313 577-2222) has personnel trained to respond sensitively to mental health emergencies at all hours.

Academic Dishonesty -- Plagiarism and Cheating:
Academic misconduct is any activity that tends to compromise the academic integrity of the institution or undermine the education process. Examples of academic misconduct include:

- Plagiarism: To take and use another's words or ideas as your own without appropriate referencing or citation.
- Cheating: Intentionally using or attempting to use or intentionally providing unauthorized materials, information or assistance in any academic exercise. This includes copying from another student's test paper, allowing another student to copy from your test, using unauthorized material during an exam and submitting a term paper for a current class that has been submitted in a past class without appropriate permission.

- Fabrication: Intentional or unauthorized falsification or invention of any information or citation, such as knowingly attributing citations to the wrong source or listing a fake reference in the paper or bibliography.

Other: Selling, buying or stealing all or part of a test or term paper, unauthorized use of resources, enlisting in the assistance of a substitute when taking exams, destroying another's work, threatening or exploiting students or instructors, or any other violation of course rules as contained in the course syllabus or other written information.

- In the unlikely event that cheating occurs, a zero-tolerance policy will be enforced, and the student will be prosecuted in accordance with the guidelines of the WSU Policy on Academic Misconduct (https://doso.wayne.edu/conduct/academic-misconduct).

Such activity may result in failure of a specific assignment, an entire course, or, if flagrant, dismissal from Wayne State University.

Course Drops and Withdrawals:
In the first two weeks of the (full) term, students can drop this class and receive 100% tuition and course fee cancellation. After the end of the second week there is no tuition or fee cancellation. Students who wish to withdraw from the class can initiate a withdrawal request on Academica. You will receive a transcript notation of WP (passing), WF (failing), or WN (no graded work) at the time of withdrawal. No withdrawals can be initiated after the end of the tenth week. Students enrolled in the 10th week and beyond will receive a grade. Because withdrawing from courses may have negative academic and financial consequences, students considering course withdrawal should make sure they fully understand all the consequences before taking this step. More information on this can be found at: https://reg.wayne.edu/students/information#dropping

Student Services:

- **The Academic Success Center** (1600 Undergraduate Library) assists students with content in

select courses and in strengthening study skills. Visit www.success.wayne.edu for schedules and information on study skills workshops, tutoring and supplemental instruction (primarily in 1000 and 2000 level courses).

- **The Writing Research and Technology Zone** is located on the 2nd floor of the Undergraduate Library and provides individual tutoring consultations free of charge. Visit http://clasweb.clas.wayne.edu/writing to obtain information on tutors, appointments, and the type of help they can provide.
- **Library research assistance:** Working on a research assignment, paper or project? Trying to figure out how to collect, organize and cite your sources? Wayne State librarians provide on- campus or online personalized help. Contact them at: https://library.wayne.edu/forms/consultation_request.php

Class recordings:
Students need prior written permission from the instructor before recording any portion of this class. If permission is granted, the audio and/or video recording is to be used only for the student's personal instructional use. Such recordings are not intended for a wider public audience, such as postings to the internet or sharing with others. Students registered with Student Disabilities Services (SDS) who wish to record class materials must present their specific accommodation to the instructor, who will subsequently comply with the request unless there is some specific reason why s/he cannot, such as discussion of confidential or protected information.

Unexpected University closures:
If the University is officially closed on an exam day, the exam will be held on the next regularly scheduled class day. Closure of the University is announced by the following mechanisms:

The University Newsline	313 577 5345
WSU Homepage	www.wayne.edu
WDET-FM	public radio station 101.9 FM
WSU emergency broadcast system	