Texas Tech University
Center for Biotechnology and Genomics

BTEC 5338
Methods in Biotechnology

**Meeting:**
- Lecture  Section 001  T  1:00-1:50  Room 120 ESB
- Laboratory  Section 501  TR  2:00-4:50  Room 105 ESB

**Instructors:**  Office Hours are by Appointment

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**Required Texts:**


**Literature:**

(full text available at http://www.jbc.org/content/273/47/30888.full.pdf+html)

**Students are expected to read assigned materials before attending class.**

**Course Description:**

This is a laboratory based course. The overall goal of this course is to equip students with a strong foundation in recombinant DNA technology. This course is broadly divided into two parts: (1) Gene cloning and (2) Recombinant Protein expression and characterization. The parts consist of experimental modules. Module I and II in gene cloning covers cloning and subcloning of a foreign gene. Module III covers recombinant protein over-expression, purification and characterization.

Reading assignments, additional materials, required experimental protocols and course announcements will be provided by the instructor as needed.
Learning Outcome:
The fully prepared student will be able to:

✓ Use various bioinformatic tools to locate genes of interest.
✓ Design constructs that can be used to over-express proteins.
✓ Isolate and purify these plasmids and carry out restriction-digest analysis of the purified plasmids.
✓ Transform bacterial cells and screen for transformed cells using antibiotic resistance.
✓ Isolate DNA and analyze sequencing data.
✓ Release expressed proteins from bacterial cells and purify the proteins.
✓ Use gel electrophoresis to monitor DNA and protein purity and to estimate their molecular masses.
✓ Measure DNA, protein concentrations and enzyme activities.
✓ Calculate specific activity.
✓ Write and maintain a lab notebook.

Lecture/Laboratory Schedule:

Introduction: From gene to protein: An overview to the cloning, overexpression, and characterization of 3-alpha-HDR from *Comamonas testosteroni*

Introduction to bioinformatics
Lab safety training and lab notebook maintenance
Reagents and Buffers

Cloning: Cloning strategies – T/A cloning
Polymerase Chain Reaction (PCR)
Electrophoresis
Transformation of *E. coli*
Blue-white screening of recombinants
Plasmid miniprep and DNA quantitation
DNA Sequencing

Subcloning: Subcloning strategies, vector selection, design and modification
Restriction digestion
Colony PCR

Protein Overexpression, Purification and Characterization:
Selection of host, mechanism of recombinant protein expression in *E.coli.*
Cell lysis methods
Epitope tagging (IMAC)
SDS-PAGE
Western blot technique
Protein quantitation
Enzyme activity and kinetics
Attendance:
Lectures and labs will include information that is not in the assigned text or handouts. **It is therefore necessary and expected that you will attend and participate in every scheduled class and lab. There are no makeup classes or labs.** If there is a reason for missing a class or a lab you must contact your instructor as soon as possible to make necessary arrangements to discuss the outcome of the absence. You may need to provide a note from your physician excusing your absence if you are absent from a class or a lab more than a day due to an illness.

Assessments and Grading:
There will be five criteria used to determine your final grade in this course. No other forms of assessment will be used and no “extra credit” will be considered. All assignments, exams, quizzes and notebook collections will be considered late if they are not submitted on the assigned date that they are due, and may receive a grade of “0.”

1. Exams: **Two-hour exams and a comprehensive final** will constitute **10%, 15% and 25%** of the course grade respectively. These are tentatively scheduled for October 4 and November 8 and the final on December 10 (1:30-4:00 p.m.).

2. Lab Notebooks: You must keep a notebook. Each experiment (or tutorial) should be represented in the notebook and **all data and observations must be recorded during the lab** - not copied over afterwards. Each should have a Title, a description of the Purpose of the experiment, a Description or Flow Diagram of the experimental procedures, a section for recording Results and a Summary and Discussion of the results. The Notebooks should be well-organized, and should reflect an understanding of the background principles, the purpose for the experimental techniques being used, and how the experimental procedures are linked to each other and the overall “flow” of the laboratory topic and project goals. The notebook will account for **30% of the final grade.** **Recording results on a piece of scrap paper while doing an experiment is completely unacceptable.**

3. Quizzes: There will be unannounced quizzes during the semester, which will constitute **10% of the total grade.** These will cover past material as well as expected reading prior to class.

4. Lab Participation: Active participation such as class and lab discussions, suggestions, and answering questions is strongly encouraged. Bench work in the lab is done in a group setting with two students in a group. Both members of the group should take equal responsibility to successfully complete lab experiments. Each person should be courteous and considerate of his/her lab partner and need to provide equal opportunity to follow lab protocols. Orderly conduct during the lab is expected at all times. Once the experiments are completed the chemicals, reagents, biological agents, and enzymes needed to be stored appropriately. All labware and bench surfaces should be cleaned before leaving the lab. **Lab participation grade will be 10% of the total grade.**
A final letter grade will be determined by performance on the above criteria, with consideration given to performance of the class as a whole. In prior years, the A/B cutoff for final grades has been around 90%, the B/C cutoff around 80%, the C/D cutoff around 70%, and the D/F cutoff around 65%. A grade of “I” (Incomplete) will be awarded by the instructor prior to the end of the semester only when failure to complete the work has been due to causes beyond the student’s control and when class performance has been satisfactory. Texas Tech regulations require that a form explaining the reason for the Incomplete and the method to be used to make up the missed work be submitted, after being signed by both the student and instructor, to the Registrar. Incomplete grades that are not replaced by an A, B or C grade within one year are automatically replaced by an F.

**Academic Honesty:** It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work not honestly performed is regarded by the faculty and administration as a most serious offense and renders the offenders liable to serious consequences, possibly suspension. Students who are assigned a grade of F in a course because of academic dishonesty, will have the reason for this grade assignment noted on their academic transcripts.

**Special Conditions:**
Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services (AccessTECH). No requirement exists that accommodations be made prior to completion of this approved university process.

**Religious Holy Day:**
A student who intends to observe a religious holy day should make that intention known to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence.