Texas Tech University **SPRING 2014**

Center for Biotechnology and Genomics

BTEC 5312: Gene Expression Analysis

When: Wednesday 2:00 - 4:50 PM

Where: Experimental Sciences Building, Room 105

Instructors: Room 108 (office hours by appointment)

Dr. Rao Kottapalli rao.kottapalli@ttu.edu P: 806-834-0592

Description: This class will introduce students to techniques of gene expression analysis and its applications.

Learning Outcomes: Students successfully completing this course will have an understanding of various methods of quantifying gene expression and application of these techniques. Students will isolate RNA and study differential gene expression by RNA-Sequencing using Next Generation sequencing. Quantitative real time PCR will be used to validate the gene expression results. Students will be introduced to topics like regulation of gene expression, gene annotation, and pathway mapping.

Course Project:

Students will be required to complete a course project. Students should work either in a topic of their interest or in groups of two or three, combining different background and expertise in each team, when possible. Start discussing project ideas you are interested in with your fellow students and with me as soon as possible - you need to have selected a project by the 6th week and a proposal has to be submitted by the 9th week. The proposal should be about 2-4 pages long and needs to reflect your understanding of the problem, briefly discuss existing and related work, describe the proposed work, specify a work schedule, and list relevant literature. The project proposals and reports will be reviewed and evaluated according to standard criteria for research proposals/research papers. A preliminary list of possible project topics is as follows:

- Identification of differentially expressed genes in various tissues
- RNA-Seq experiment to understand the mechanisms of stress response
- Small RNA-Sequencing to understand post-transcriptional gene regulation.
- Understanding the mechanisms of disease resistance by RNA-Seq

If you have other ideas for potential projects, come talk to me - I look forward to hearing about your ideas!

Tentative Schedule:

1/15 Introduction to RNA and gene expression. Methods of RNA extraction – total RNA, mRNA, small RNA.

1/22 RNA Extraction, quantification and quality analysis.

1/29 Gene expression Profiling – RNA-Sequencing principles, methods, and applications.

2/5 RNA-Sequencing cDNA libraries preparation.

2/12 RNA-Sequencing cDNA library quality analysis and quantification.

2/19 Expression profiling by sequencing – **Class Seminar,** Sequence assembly principles.

2/26 RNAseq data analysis, calculation of fold changes and generation of differentially expressed gene lists.

3/5 Gene annotation and pathway mapping.

3/12 Small RNA and Epigenetic regulation of gene expression. **Class Seminar**

3/19 **SPRING BREAK**

3/26 Gene expression validation. Quantitative real-time PCR – principles. Semi-quantitative PCR.

4/2 Basic Quantitative real-time PCR considerations, primer and probe designing. Design of experiments.

4/9 Absolute quantification – Exercise and setting up of qRT-PCR. Data analysis.

4/16 Relative quantification – visit to USDA for quantification on a different platform.

4/23 Applications – Case studies of gene expression analysis.

4/30 Review and discussion of student projects

5/13 Final - Class Seminar and project submission.

Methods of assessment of learning outcomes:

Learning outcome will be assessed through written examination and reports. Participation in discussions and questioning during class will also be used for assessing learning outcomes. Course Assignment/Description of how grades are determined:

Participation/presentation/reports/quiz:	75% Final
exam/project:	25%

A final letter grade will be determined by performance on the above criteria, with consideration given to performance of the class as a whole. 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.

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.

Academic Integrity: 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.

"Scholastic dishonesty" includes, but not limited to, cheating, plagiarism, collusion, falsifying academic records, misrepresenting facts, and any act designed to give unfair academic advantage to the student or the attempt to commit such and act.

Cheating: Dishonesty in examinations, quizzes, or home work assignments, illegal possession of examinations, the use of unauthorized notes during an examination or quiz, obtaining information during an examination from the examination paper or otherwise from another student, assisting others to cheat, alteration of grade records, illegal entry to or unauthorized presence in an office are instances of cheating.

Plagiarism: Offering the work of another as one's own, without proper acknowledgement, is plagiarism; therefore any student who fails to give credit for quotations or an essentially identical expression of material taken from books, encyclopedias, magazines, internet web sites, and other reference works, or from the themes, reports or other writings of a fellow student is guilty of plagiarism.

Civility in the Classroom: Students are expected to assist in maintaining a classroom environment that is conducive to learning. In order to ensure that all students have an opportunity to gain from time spent in class, unless otherwise approved by the instructor students are prohibited from using cellular phones or beepers or engage in any other form of distraction. Inappropriate behavior in the class room will result in a request to leave the class.

Attendance: It is expected that you will attend and participate in every scheduled class. There are no makeup classes. If there is a reason for missing a class you must contact the 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 more than a day due to an illness.

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.

Ombudsman for students: The Ombudsman for students is available to assist students with any conflict or problem that has to do with being a student at Texas Tech University. You may visit the Ombudsman at Student Union Building or call 742-4791.