Texas Tech University Spring 2015

Center for Biotechnology and Genomics

Course Number:	BTEC 5001-001
Course Name:	Topics in Biotechnology: Nanobiotechnology
Course Instructor:	J. N. Tripathy, Ph.D., M.BA. Office: EXPSc Room 103 Phone: (806) 834-1837 Email: Jatindra.n.tripathy@ttu.edu
Meeting:	W 9:00 to 11:50 AM, EXPSC Room 105
Office hours:	On appointment

Course Description:
This course surveys the principles, techniques and tools used in the design and synthesis of genetically encoded nanoparticles and their various applications in biotechnology. There will be a major emphasis on how to design, synthesize, purify and characterize the peptide based nanoparticles (Elastin-like polypeptides, ELPs).

Four major areas of focus:

- Design of elastin-like polypeptide (ELPs)
- Synthesis of ELPs using recombinant DNA technology
- Purification of ELPs by using their own reversible, inverse temperature phase transition properties
- Biochemical and biophysical characterization
- Application in drug delivery

This course is a purely laboratory oriented course that addresses the role of nanoparticles in practice.

Course Material:
There is no text book for this course. However, there are some books available that you might consider to study to gain overall knowledge and understanding in nanotechnology. I will provide the necessary study materials, experimental protocol in advance for you to use in the class and laboratory.

Course Prerequisites:
A sound foundation in molecular biology, biochemistry, and organic chemistry is required for this course.

Course Objectives and Expected Learning Outcomes:
At the end of the course, the fully prepared student will be able to: explain what nanoparticles are all about and their unique properties and various applications in the biotechnology industry; conceptualize the organization of nanoparticles and their synthesis and characterization; and describe the issues, concerns and current challenges of nanotechnology.

Course Organization:
The class will meet every Wednesday during the semester (excluding university holidays). Each week will have a lecture followed by the laboratory session. This semester experimental plan for laboratory is as follows:

Each student will be provided a 75 nucleotide sequence. This is a unique repeats of 25 amino acids (pentamer repeat units - one repeat) which is the starting material. The student is required to construct many repeats (2, 4, 6, 8, 16, 32, 64, 72, 96 etc.) using the recursive directional ligation (RDL) method (the success of which depends on how meticulously the entire experiment is planned, designed and carried out in a week), express and purify the protein using technique- inverse thermal cycling (ITC), characterize it by using many biophysical and biochemical techniques.

Attendance:
You are **expected** to attend and participate in every scheduled class. **There are no makeup classes.** If there is a reason for missing a class you must contact me as soon as possible to make necessary arrangements to discuss the outcome of the absence. **You must provide a note from a qualified physician if you remain absent due to illness.**

Grading:
1. Midterm, February 25 (30% of total grade). The exam questions will be based on the lecture, handouts and the assigned reading materials.

2. Midterm Presentation: (30% of total grade): Each student is required to discuss an ELP related publication. Students will discuss the methodology, objectives, and results in detail in their presentation. I will assign the paper at least two weeks before the presentation. The duration of the presentation is around 20 minutes followed by 10 minutes discussion will be strictly followed.

3 Final Report and Presentation: (30% of the course grade). April 29. The report should contain an introduction, objective, hypothesis, review of relevant literature, methodology followed, results, discussion and conclusion. All the figures and table should be labeled and literature should be cited properly. The discussion part of your paper should focus a clear scientific explanation of the success and failure (if any) of your project.

4. Class Participation (10% of the total grade).

Academic Honesty:
It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and 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.

Religious Holy Day:
A student who intends to observe a religious holy day should make that intention known to the instructor at the beginning of the semester. 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.

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 during the instructor's office hours. Please note instructor is not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office at 335 West Hall or 806-742-2405**.**

Course Schedule

Lecture

1/14 Week 1: Nanobiotechnology origin, history, and application

1/21 Week 2: Introduction to ELPs, design, synthesis and application

1/28 Week 3: Vector design and RDL method concepts

2/4 Week 4: Vector design and RDL method concepts contd.

2/11 Week 5: Construction of ELP library

2/18 Week 6: Purification of ELP using ITC methods

2/25 Week 7: Midterm exam

3/4 Week 8: Midterm Presentation

3/11 Week 9: Midterm Presentation

3/18 Week 10: Spring Break, No class

3/25 Week 11: Characterization of ELPs

4/1 Week 12: Characterization of ELPs contd.

4/8 Week 13: Application of ELPs

4/15 Week 14: Application of ELPs contd.

4/22 Week 15: Concerns and challenges of nanotechnology

4/29 Week 16: Final Presentation

Laboratory

Lab 1 – Annealing of oligoes, Vector digestion

Lab 2 – Vector preparation, set up Ligation reaction

Lab 3 – Transformation

Lab 4 – Miniprep, send for sequencing

Lab 5 – Analysis of sequence, Double digestion

Lab 6 - depends on the result of the above experiment.