

SELECTED TOPICS IN CHEMISTRY: BIOANALYTICAL CHEMISTRY
CHEMISTRY400B
Fall Semester 2017

Class meets on Tue and Thu from 8:00 to 9:15 AM in 200 LaTourette

- Instructor:** Professor Irina V. Nesterova
Office: 433 LaTourette
Lab: 435&436 LaTourette
Office Phone: (815) 753-6853
E-mail: inesterova@niu.edu
- Office Hours:** Tue, Thu 9:20-10:20 am or by appointment. To make an appointment: contact me either via e-mail or via phone or in person.
- Course Description:** This one-semester-two-1.5-hour-lecture-per-week course will discuss fundamental principles of chemical analysis in biological systems. The course is built around nature of target starting from small molecules moving toward oligonucleotides, proteins/peptides, and, finally to whole cells.
- Course Objective:** The course objective is to provide basic knowledge and understanding of underlying principles, capabilities, and limitations of common methods currently utilized in bioanalytical laboratories.
- Course Expectations:** Students taking this class are expected to spend 3 hours per week in the classroom and a minimum of 6 hours per week *outside of the class* for a total of 9 hours/week. The outside of class time will include reading assigned materials in preparation for the upcoming class, reviewing notes from attended classes, working on homework, preparing a term paper and presentation (*vide infra*), etc.
- Course assessment:** There will be four (4) graded homeworks, two exams and a term paper. The topic of the term paper and presentation will be the same. The list of suggested topics will be provided. However, you can chose a course-related topic on your own with my approval. The evaluation criteria for the term paper will be distributed.
- Textbook:** No required textbook. All the necessary materials will be uploaded on Blackboard.

Grading**structure:**

<u>Type of assessment</u>	<u>Points:</u>	<u>%</u>
Homeworks (4)	$4 \times 20 = 80$	22 %
Term paper:	60	17 %
Exam 1:	100	28 %
Exam 2:	100	28 %
Class participation:	20	5 %
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Total:	360	100 %

Final grade:

will be based on the total number of points and may be curved at the end of semester:

**Late submission
policy:**

Late submissions of homework and a term papers is allowed within a week from the deadline with 25 % deduction of the points. Absolutely no submission after more than a week after deadline.

Important dates:

Homework 1 due:	September 19 th , 2017 (end of the day)
Homework 2 due:	October 5 th , 2017 (end of the day)
Homework 3 due:	October 31 st , 2017 (end of the day)
Homework 4 due:	November 14 th , 2017 (end of the day)
Exam 1:	October 10 th , 2017
Exam 2:	November 16 th , 2017
Term paper due:	December 7 th , 2017 (end of the day)

Accommodations for students**with disabilities**

If you need an accommodation for this class, please contact the Disability Resource Center as soon as possible. The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 or drc@niu.edu.

Also, please contact me privately as soon as possible so we can discuss your accommodations. Please note that you will not be required to disclose your disability, only your accommodations. The sooner you let me know your needs, the sooner I can assist you in achieving your learning goals in this course.

Make up policies:

Make-up exams will only be given when official paper documentation is provided that clearly indicates that circumstances beyond a student's control (such as illness, jury duty, accident, or a death in the family) prevented the

student from taking a scheduled test. To request a make-up exam you must contact me no later than 48 h following the missed test.

Tentative list of topics to be discussed

Section 1. Bioanalysis in Drug Discovery and Development

- 1.1 Overview of place for bioanalysis in drug discovery and development: pharmacokinetics, toxicokinetics, metabolite profiling
- 1.2 Revisiting of analytical methods: chromatography
- 1.3 Sample preparation techniques
- 1.4 Method validation
- 1.5 HTS strategies

Section 2. Analysis of nucleic acids

- 2.1 DNA and RNA in bioanalytical chemistry
- 2.2 DNA extraction and isolation
- 2.2 Revisiting of analytical methods: electrophoresis, fluorescence spectroscopy
- 2.2 DNA amplification: PCR and qPCR; RNA “amplification”: RT-PCR
- 2.3 Sanger sequencing, automatic sequencing (capillary array), human genome project
- 2.4 Next generation sequencing technologies
- 2.5 DNA detection – hybridization assays, Southern blotting
- 2.6 Forensics: Restriction fragment analysis, short tandem repeats
- 2.7 Transcriptomics: mRNA analysis.
- 2.8 Affinity probes: molecular beacons, aptamers.

Section 3. Analysis of proteins

- 3.1 Proteins, their structure, abundance and meaning for bioanalytical chemistry
- 3.2 Revisiting of analytical methods: mass spectrometry, protein separation techniques
- 3.3 Protein separation methods – cell fractionation, chromatography, electrophoresis, two-dimensional separations
- 3.4 Bottom-up proteomics
- 3.5 Immunoassays. Antibodies, Western blot, Enzyme immunoassays (ELISA).
- 3.6 Analysis of post-translational modifications

Section 4. Analysis of cells and their structure.

- 4.1 Microscopy. Light, fluorescent, confocal, electron, SEM
- 4.2 Flow cytometry