

## Syllabus

### BIOL 4524/5524 Biological Laboratory Instrumentation Fall 2011

Meeting times- Lecture: MW 10:30-11:20 AM LSE113; Lab: F 12:30-4:20PM LSE 301

Instructor: Chris Wood, HBRC 230E, phone 4-5529

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Office Hours: Will be determined in class or by appointment

Prerequisites: a general chemistry course such as CHEM 1515 or equivalent; a biology course such as BOT 1404 or equivalent, or MICR 2123 or equivalent, or ZOOL 1604 or equivalent; or permission of instructor.

#### Textbook and readings:

Lisa A. Seidman, Cynthia J. Moore, "Basic Laboratory Methods for Biotechnology" 2<sup>nd</sup> Ed. (New Jersey: Prentice-Hall 2009)

Excerpts from equipment manufacturer's manuals and additional handouts.

#### Course Structure and Grading:

There will be two 50-minute lectures and one 200-minute lecture/lab per week. The lectures will be devoted to presenting the theory and practical use of different techniques and instrumentation. The laboratory meeting will provide demonstrations and hands-on experience with the techniques and equipment. Readings will include a textbook on laboratory methods for biotechnology as well as manufacturer's instrument manuals and handouts.

Protocol assignments involve researching and creating a laboratory protocol using an approved instrument.

Homework assignments will include biological conversions and calculations, writing instrument protocols and using resources on the Internet such as GenBank tools and databases.

The course grade will be determined according to the following criteria:

<b>All students enrolled in BIOL 4524 and 5524:</b>	<b>Points</b>
2 Exams (100 points each)	200
4 Quizzes (25 points each)	100
2 Protocol assignments (25 points each)	50
5 Take home assignments (Homework) (10 points each)	50
1 Final Exam	200

**Total -- 600 points**

**Students enrolled in 5524 (Graduate credit) only:**

In addition to the 4524 requirements listed above-

100pt. User's manual/Trouble-shooting guide and presentation (Instrument choice must be approved by the instructor). See the guidelines provided for instruction.

**Total -- 700 points**

The grading scale will be: 90% or above A  
80% or above B  
70% or above C  
60% or above D

Assignments are due at the beginning of class on the stated due date. A late penalty of 10% will be assessed for each academic day late.

**Attendance Policy**

You are expected to attend every class period. There will be no make up for exams or quizzes unless the student has a valid excuse. This excuse **MUST** be documented and I will ask to see this documentation. If you are going to miss an exam for a valid reason, you **must** contact the instructor prior to the start of the exam. Send me an e-mail, call, or leave a note on my door, and make sure you include your e-mail **and** a phone number where I can contact you.

Assignments are due at the beginning of class on the stated due date. A late penalty of 10% will be assessed for each academic day late.

**Academic Integrity**

The Oklahoma State University Policy and Procedures document on Academic Integrity will be followed. This can be found on line at <http://academicintegrity.okstate.edu/>

Oklahoma State University is committed to the maintenance of the highest standards of integrity and ethical conduct of its members. This level of ethical behavior and integrity will be maintained in this course. Participating in a behavior that violates academic integrity (e.g., unauthorized collaboration, plagiarism, multiple submissions, cheating on examinations, fabricating information, helping another person cheat, unauthorized advance access to examinations, altering or destroying the work of others, and fraudulently altering academic records) will result in your being sanctioned. Violations may subject you to disciplinary action including the following: receiving a failing grade on an assignment, examination or course, receiving a notation of a violation of academic integrity on your transcript (F!), and being suspended from the University. You have the right to appeal the charge. Contact the Office of Academic Affairs, 101 Whitehurst, 405-744-5627, [academicintegrity.okstate.edu](http://academicintegrity.okstate.edu).

The OSU Syllabus Attachment for Fall 2011 is made a part of this course syllabus. The syllabus attachment may be found online here:

<http://academicaffairs.okstate.edu/images/documents/sylatfa.pdf>

## **Semester Schedule:**

### **Week 1 (8/22): Laboratory Setup and Safety**

8/22: Intro to class, Lab Setup, Lab Documentation, Standards, Controls, Error

8/24: Solutions, Concentrations, Master Mix calculations, standard curves

8/26 Lab: Exercises in laboratory calculations, discussions on laboratory quality and documentation; PPE equipment, Chemical Hygiene Plan.

### **Week 2 (8/28): Mass and Volume measurements**

8/29: Mass and weight, balances, balance calibration and maintenance

#### **Homework 1 due**

8/31: Volume measurement devices: Pipettor maintenance, testing and calibration.

Intro to the Biomek Liquid Handling system

9/02 Lab: Balance use and calibration, Pipettor use and calibration.

### **Week 3 (9/05): pH/ISE meters and probes**

9/05: **Labor Day – No Class**

9/07: Introduction to pH & electrochemistry, ion measurements, pH meters and calibration, buffer preparation, probe rejuvenation and validation.

#### **Homework 2 due**

9/09 Lab: **Quiz 1** pH/ISE meter & probes; Water purification & Autoclaves

### **Week 4 (9/12): Measurements involving light**

9/12: Basic principles and instrumentation

Use and calibration of spectrophotometers and fluorometers

9/14: Applications and methods, plate readers

9/16 Lab: Photometric methods, spectrophotometer calibration

### **Week 5 (9/19): Macromolecule properties, structure and function**

9/19: Maintaining the structure and function of proteins

Nucleic acid and protein concentrations, enzymatic assays

9/21: Maintaining the structure and function of nucleic acids

9/23 Lab: **EXAM I**, Protein and Nucleic acid concentration determination, standard curve

### **Week 6 (9/26): Chromatography**

9/26: Chromatographic theory, Size Exclusion, Ion Exchange and Hydrophobic Interaction Chromatography, Affinity Chromatography

9/28: HPLC, and FPLC **Protocol 1 due**

9/30 Lab: Chromatographic equipment demo and discussion

#### **Homework 3 due**

### **Week 7 (10/03): Electrophoresis I**

10/03: SDS-PAGE, Isoelectric focusing

10/05: 2D-PAGE, Introduction to Proteomics

10/07 Lab: SDS-PAGE, Western blot techniques

### **Week 8 (10/10): Radioisotope and Imaging**

10/10: Liquid scintillation counting (LSC) - Demonstrations of LSC and autoradiography

10/12: Autoradiography and phosphorimaging.

10/14 Lab: **Fall Break – No Class**

### **Week 9 (10/17): Electrophoresis II**

10/17: Agarose and starch gels, Introduction to Agilent 2100 Bioanalyzer

Electrophoresis use and demonstrations

10/19: Southern, western, far-western, and northern blots, electrophoretic transfer Immunoprobng

10/21 Lab: **Quiz 2** Demonstration of agarose gels, blotting and imaging techniques

**Week 10 (10/24): Centrifugation**

10/24: Use of microfuges, clinical, superspeed, and ultracentrifuges  
Differential, Isopycnic, and Rate-zonal centrifugation

**BIOL 5524 only: User's guide rough draft due**

10/26: Spin columns, ultrafiltration, and diafiltration, filter plates

10/28 Lab: **EXAM II** Cell fractionation techniques

**Week 11 (10/31): Nucleic Acid Techniques I**

10/31: PCR techniques and thermocyclers, calibration and maintenance

11/02: PCR primer design and trouble-shooting

11/04 Lab: DNA isolation, PCR, Agarose gel electrophoresis

**Week 12 (11/07): Nucleic acid techniques II**

11/07: DNA sequencing, Sequence Analysis

**Homework 4 due**

11/09: Next Generation Sequencers

**Protocol 2 due**

11/11 Lab: Field trip – DNA sequencing core & Proteomics core

**Week 13 (11/14): Nucleic acid techniques III**

11/14: Troubleshooting DNA sequencing and Fragment Analysis

11/16: Gene Expression analysis and Real-time PCR

11/18 Lab: RNA quality assessment, Agilent Bioanalyzer II, qPCR trouble-shooting

**Quiz 3**

**Homework 5 due**

**Week 14 (11/21): DNA Microarray Technology**

11/21: DNA Microarrays—An overview; use of microarray scanners

11/23: **Thanksgiving Break – No Class**

11/25 Lab: **Thanksgiving Break – No Class**

**Week 15 (11/28): High Resolution Melting analysis (HRM) and Genotyping**

11/28: High Resolution Melting equipment

11/30: HRM analysis and trouble-shooting

12/02 Lab: Using HRM and microsatellite markers for genotyping

**Quiz 4**

**Week 16 (12/05): Intro to Proteomics, Bioinformatics Techniques**

12/05: Overview of MALDI-TOF MS

12/07: Web-based software, databases, EMBOSS, Linux commands

12/09 Lab: HPC cluster use, scripts and pipelines

**User's manuals/guides due (BIOL 5524 graduate credit only)**

**Final Exam during scheduled time: 10-11:50 AM, Wednesday, December 14, 2011.**

The topics for these dates may (and probably will) change during the course of the semester. Please show up for class for timely updates to the topics covered in class.