

Fall 2008

BMS 556

Biodefense Laboratory Sciences

9:00 -12:00 Wednesdays
(1 Credit)

Dr. Christina Egan (BMS)
Course Director

Course Policies

Purpose/Learning Objectives: Students should gain an understanding and appreciation for issues impacting Biodefense Laboratory processing and regulation. Inclusive in this will be; understanding of Biosafety Levels (BSL), appropriate personal protective equipment for defined BSL, working in biosafety cabinets, decontamination methods, amplification and detection methods, and general biosecurity practices. The students in this course will gain an understanding of the role of the laboratory in a bioterrorism event.

Course Description: This course will provide an introduction to the procedures and methods to safely and securely work with these agents in the laboratory. Overviews and use of diagnostic methods will be presented including culture, immunoassay and nucleic acid amplification. The laboratories are designed to give students an understanding of the testing flow used for biothreat analysis and emerging infectious disease as well as some of the specialized techniques and technology that the Wadsworth Center has used in real-world testing of these types of samples. The students will take analysis from the beginning stages of specimen/sample arrival through rapid and confirmatory testing that will be taught throughout the laboratories.

Faculty:

Course Director-	Dr. Christina Egan	eganc@wadsworth.org
Additional Instructors-	Dr. Nick Cirino	ncirino@wadsworth.org
	Dr. Kimberlee Musser	musser@wadsworth.org
	Ms. Cassandra Kelly	kelly@wadsworth.org
	Dr. Nick Mantis	nmantis@wadsworth.org
	Dr. Kristen Bernard	kab17@health.state.ny.us
	Dr. Steve Zink	sdz01@health.state.ny.us

Suggested Texts

No text book is available for the breadth of topics in this course. Reading and study material will be compiled from open literature sources and distributed to students at beginning of each section. Selected sections from the following texts and resources will be utilized:

Biosafety in Microbiological and Biomedical Laboratories, 5th Edition. 2003. Jonathan Richmond and Robert McKinney, Eds. US Government Printing Office, Washington, DC.

Bioterrorism: Guidelines for Medical and Public Health Management. 2002. Donald Henderson, Thomas Inglesby, Tara O'Toole, Eds. AMA Press, Chicago, IL.

Manual of Clinical Microbiology, 8th Edition. 2002. Murray, Baron, Tenover, Tenover, Eds. ASM Press, Washington, DC.

Websites:

<http://www.bt.cdc.gov/> This is an excellent resource for information on bioterrorism select agents and public health emergency preparedness and response.

<http://www.hopkins-biodefense.org/>. This is the website for the Center for Civilian Biodefense Strategies

Homework and Help: All course instructors will have at least 2 hours per week available for students with questions or requesting additional tutoring. Homework will be primarily reading assigned materials.

Meets: Wednesdays for 3 hours

Grading: A-C, E

Student Evaluation: Students will be evaluated using a comprehensive final written exam (40%), and a hands-on lab practical exam (30%), class participation (20%), and laboratory notebook and laboratory assignments (10%).

Course Evaluations: Following completion of course, students will be asked to evaluate course for content, presentations, materials, lecturers, and overall utility.

BMS 556 Biodefense/Emerging Infectious Diseases Laboratory Sciences Course Syllabus

Laboratory 1- Mr. David Hill/Dr. Christina Egan (Wadsworth) Course overview/ BSL Levels/Biosafety Practices

Biosafety review, Working in a BSL3 laboratory, Entry/Exit procedures for BSL3 laboratory, Safety in a BSL3 laboratory, Biosecurity, Select agent regulations. Class participants will review these principles, tour the BSL3 laboratory, and then enter, dress, and practice the use of proper microbiological practices in the mock BSL3 laboratory.

Laboratory 2- Dr. Kristen Bernard (Wadsworth) Viral Culture Methods I

Viral culture techniques will be taught in this lab. Students will learn how to perform plaque assays to determine cytopathic effect and proper aseptic cell culture technique.

Laboratory 3- Dr. Kristen Bernard (Wadsworth) Viral Culture Methods II

Using the techniques of Viral Culture Methods I, advanced virology methods will be covered in this lab. Students will learn how to perform Tissue Culture Infecting Dose (TCID50) and virus neutralization assays.

Laboratory 4-Dr. Christina Egan (Wadsworth) Bacterial Culture Methods/ Biosafety Cabinet Techniques

Sterile aseptic technique, proper biosafety and use of the biosafety cabinet. Students will grow bacterial strains and learn to quantitate organisms. Students will also learn how environmental biothreat samples are processed in a BSL laboratory.

Students will learn how to perform and interpret routine bacteriological staining techniques such as Gram and Wayson staining. Students will also visualize bacterial cells using direct fluorescent antibody staining. Organisms that were isolated from the environmental biothreat sample will be used for this laboratory from laboratory #2. Identification of biothreat organisms such as *Bacillus anthracis*.

Laboratory 5- Lab Practicum

Laboratory 6-Dr. Nick Mantis (Wadsworth) Antibody Based methods

Antibody-based assays will be reviewed such as ELISAs, Western blots, immunofluorescence, and microsphere immunoassays. Students will learn how to measure antibodies in serum and mucosal secretions from mice that react with ricin and staphylococcal enterotoxin B as well as how to perform cytotoxicity assays and ELISAs for toxin identification.

Laboratory 7-Dr. Kim Musser (Wadsworth) DNA isolation techniques in BSL3 laboratory

Discuss DNA and RNA techniques, chemistry of extractions, commercially available kits, robotic instrumentation, Samples types (clinical, food, water, and powders), and PCR inhibition. Students will extract bacterial DNA in the BSL3 laboratory. DNA will also be quantitated. Students will also learn how DNA extractions are performed on

various environmental sample and will perform DNA extraction on samples processed in laboratory #2. Observe robotic extraction utilized for Biodefense Protocols.

Laboratory 8-Dr. Nick Cirino (Wadsworth) Nucleic Acid Based Methods I

Basic PCR concepts, RT-PCR applications, example of multiplex PCR will be covered in this laboratory. Students in this laboratory will learn how to perform a conventional PCR assay for *B. anthracis* using the samples that they processed and extracted in laboratory #7.

Laboratory 9-Dr. Nick Cirino (Wadsworth) Nucleic Acid Based Methods II

Real-time PCR concepts and Fluorescence resonance energy transfer (FRET) will be reviewed in this laboratory as well as the strengths and weaknesses of various real-time PCR systems. Students in this laboratory will learn how to perform real-time PCR assays for *B. anthracis* utilizing DNA samples that were extracted in laboratory #7.

Laboratory 10- Ms. Cassandra Kelly (Wadsworth) Advanced High Containment Training

Students will become familiarized with working in a mobile BSL3 laboratory using a BSL3 glovebox. They will obtain additional high containment training.

Laboratory 11- Dr. Steve Zink (Wadsworth) Microscopy/Spectroscopy Methods

Microscopy and spectroscopy methods such as Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), and Fourier-Transform Infrared (FTIR) spectroscopy will be reviewed in this laboratory. Students will also learn how to use the Illuminator system to rule-out and identify various environmental powders using the environmental samples that were processed in laboratory #2.

Laboratory 12-All- Comprehensive Exam/Lab Practical

Lecture	Topic	Instructor	Date
1	Course overview/ BSL Levels/Biosafety Practices	Hill/Egan	9/3/08
2	Viral Culture Methods I	Bernard	9/10/08
3	Viral Culture Methods II	Bernard	9/17/08
4	Bacterial Culture Methods/Biosafety Cabinet training	Egan	9/24/08
5	Lab Practicum		10/3/08
6	Antibody Based methods	Mantis	10/15/08
7	DNA isolation techniques in BSL3 laboratory	Musser	10/22/08
8	Nucleic acid Based Methods I	Cirino	10/29/08
9	Nucleic acid Based Methods II	Cirino	11/5/08
10	High Containment training	Kelly	11/12/08
11	Spectroscopic Methods/Emerging technologies	Zink	11/19/08
12	FINAL Comprehensive Exam	All	12/3/08