Course Title: **“Introduction to Biosafety”**

Target audience:

- 5-credit: any interested undergraduate student from any background. This course is intentionally designed without prerequisites. Course could function as an introduction to biosafety for undergraduates who want a minor in biosafety and/or career interest in biosafety/occupational safety
- 1-credit: undergraduate programs hoping to improve the safety in their labs as part of the intro training for the sciences
- Graduate programs hoping to improve biosafety in their labs, a part of the intro training for those in the sciences. With the hopes that it will become a staple in training much like bioethics.

Expected term: 12-15 five-day weeks

5 credit hours: three 1.5 hour class sessions per week

1 credit hour: one 1 hour class session per week

Week 1:

Introduction and History	Exercise/Lab	1-credit	5-credit	Grad
Introduce instructor and students to each other	E	X	X	
History of Biosafety (Bioweapons)		X	X	X
LAI’s (lecture)		X	X	X
Intro to BSL’s		X	X	X
LAI Case Studies	E	X	X	X
Movie Night: *Outbreak*	E	homework	X	

Week 2:

Basic Microbiology and Epidemiology†	Exercise/Lab	1-credit	5-credit	Grad
Basic Microbiology*	L	X	X	X
*Mycology				
*Bacteriology				
*Virology				
*Parasitology				
*Toxins				
Host-pathogen interactions (animal models for disease)	L	X	X	X
Aerobiology video and basics terminology	L/E		X	X
Disease transmission and epidemiology	L/E	X	X	X
Aseptic technique	L/E	X	X	X
Standard Microbiological Practices	L/E		X	X

*Inclusion of this series of lectures presumes that this course is offered to a broad audience and does not include many (if any) prerequisites. If the school determines that a course in microbiology is a prerequisite for Introduction to Biosafety, then consider removing the didactic components and keeping the practical components focused primarily on Aseptic technique and Standard Microbiological practices. Regardless, the instructor should tailor the content of this section to the audience; i.e. Parasitology lecture should not be offered in a setting where no parasite work will be done even though multiple categories of microbes will be included in this curriculum package

‡Chemical and radiation safety should be available to students from chemistry instructors. It is not included in this course as this course is focused on biological safety. Please verify with Chemistry faculty that they are receiving this training and consider assessing their chemical safety curriculum

L= Laboratory needed, E= interactive or exercise

Week 3:

Molecular biology	Exercise/Lab	1-credit	5-credit	Grad
Central Dogma		X	X	X
Common techniques			X	
Impacts on Risk Assessment and BSL	E	X	X	X
Current trends			X	X
Case studies/project assignments	E	X		X
rDNA guidelines, Asilomar, and the IBC			X	X

†Inclusion of this series of lectures presumes that this course is offered to a broad audience and does not include many (if any) prerequisites. If the school determines that a course in molecular biology is a prerequisite for Introduction to Biosafety, then consider removing the didactic components and keeping the practical components focused primarily on the impact of molecular biology upon a risk assessment and BSL.

Week 4:

Risk Assessment	Exercise/Lab	1-credit	5-credit	Grad
What is a Risk Assessment and how to do it		X	X	X
Informal, dynamic risk assessment		X	X	X
Case studies and projects				X

Week 5:

Biosafety Levels	Exercise/Lab	1-credit	5-credit	Grad

Biosafety Level 1			X	X
Biosafety Level 2 ← focus here!		X	X	X
BSL-2 “with -3 Practices” aka “enhanced” aka “plus”		X	X	X
Biosafety Level 3		Brief!	X	X
Biosafety Level 4		Brief!	X	X
Plants and animals in containment: greenhouses, rodents, fish, arthropods, nonhuman primates, exotic species, and BSL-3 Ag			X	

Week 6:

Personal Protective Equipment	Exercise/Lab	1-credit	5-credit	Grad
Routes of exposure		X	X	X
Types of PPE		X	X	X
Selection and proper fit, use, of PPE	E	X	X	X
Cross-contamination and proper doffing, disposal of PPE	E	X	X	X
Poor combinations of PPE (more =/= better)			X	X

Week 7:

Laboratory Facilities and Safety Equipment	Exercise/Lab	1-credit	5-credit	Grad
Biosafety Cabinet: design, operation, use, and misuse ← focus!	E	X	X	X

Sharps Safety		X	X	X
Mechanical pipetting devices (principle of engineering controls)		X	X	X
Containment - Directional Airflow, cross-contamination, etc.		X	X	
Building Automation Systems			X	
“Million Dollar Sentences” (mistakes in facility design)			X	X
Fire detection and control systems			X	
Effluent decontamination systems (optional)			X	
Facility layout and material flow			X	
Design a facility assignment	E		X	

Week 8:

Disinfection and Decontamination	Exercise/Lab	1-credit	5-credit	Grad
Spill cleanup	E	X	X	X
Waste disposal		X	X	X
Selection of disinfectants	E	X	X	X
Mechanisms of action and categories of disinfectants			X	
Mixed waste			X	X

Week 9:

Regulatory Compliance and Best Practices	Exercise/Lab	1-credit	5-credit	Grad
The value of negative data			X	

If you didn't write it down, it didn't happen			X	X
The inspection process			X	
Potential consequences of non-compliance			X	
Select Agents - DSAT, APHIS		X	X	X
APHIS (permits for plants, soils, and animals)			X	
AAALAC		X	X	X
OLAW/NIH OBA		X	X	X
OSHA			X	
DOT/IATA (Div. 6.2)		X	X	X

Week 10:

Laboratory Security & Emergency Response	Exercise/Lab	1-credit	5-credit	Grad
Personnel suitability			X	X
Insider threat awareness: Self- and Peer-Reporting (the lab is a family mentality)		X	X	X
Targeted violence process			X	X
Mental health awareness and available resources			X	X
Physical security - access control			X	X
Information security			X	X
Emergency response, disaster response, and continuity of operations		X	X	X

Optional Course Content

Challenges and current topics in Biosafety (second optional week)	Exercise/Lab	1-credit	5-credit	Grad
Achieving compliance - working with recalcitrant elements and imperfect channels of communication			X	
Limited resources - one constant in a dynamic landscape			X	
Laboratory definitions			X	
International biosafety			X	
Leading edge metrics - how do you gather them?			X	
How important is vocabulary? The difference between an aerosol and a droplet exposure			X	
Public perception - Movie Night 2: Con*tagion* homework or a final assignment	E	X	X	
Practicum - Site inspection with the students report	E	X	X	X

Optional Course Content

The Facets of Biosafety - interactions with:	Exercise/Lab	1-credit	5-credit	Grad
Laboratory and research staff			X	
Vendors and contractors			X	
Fire and life-rescue			X	
Local police department			X	
Government agencies (regulatory and non-)		X	X	X

Occupational medicine		X	X	X
Industrial hygiene			X	
Legal counsel			X	
Risk management			X	
Public Relations			X	
Facilities/operations		X	X	X
Laboratory support		X	X	X
Institutional leadership			X	
Chemical Safety/HAZMAT			X	X
Radiation Safety/NRC		X	X	X
Veterinary staff		X	X	X
Exercise: 5 People You Should Know (BSO, Occ Health MD, etc.)	E	X handout	X	

Optional Course Content, cont.

Administrative Controls (optional extra credit)	Exercise/Lab	1-credit	5-credit	Grad
Replacement/substitution with a lower hazard			X	
Standard Operating Procedures		X	X	X
Institutional policies		X	X	X
Signs, placards, and other mass media			X	X
Administrative systems and programs in place to support biosafety		X	X	

Resources for Instructor:

- Biosafety in Microbiological and Biomedical Laboratories, 5th ed.
- Biological Safety, Principles and Practices, 4th ed. (Fleming & Hunt)
- Guide For The Care and Use of Laboratory Animals, 8th ed. (National Research Council)
- Control of Communicable Diseases Manual, 20th Ed. (Heymann)
- Institutional Animal Care and Use Committee Guidebook, 2nd ed.
- NIH Guidelines For Research Involving Recombinant or Synthetic Nucleic Acid Molecules (2013)
- Laboratory Biosafety Manual, 3rd ed. (WHO)

suggestions for a molecular biology reference text welcomed