LSC Use Only No:	LSC Action-Date:	UWUCC USE Only No.	UWUCC Action-Date:	Senate Action Date:
		04-13b	Appr 10/26/04	Appr 12/7/04

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person	Email Address
Drs. A. Andrew, N. Bharathan, Seema Bharathan	atandrew@iup.edu, bharathn@iup.edu
Proposing Department/Unit	**Phone**
SDR/Science for Disaster Response	724-357-2354

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

__X__ New Course _____ Course Prefix Change _____ Course Deletion

_____ Course Revision _____ Course Number and/or Title Change _____ Catalog Description Change

Current Course prefix, number and full title	*Proposed course prefix, number and full title, if changing*
	SDR 111 Basic Biological Laboratory Operations

2. Additional Course Designations: check if appropriate

_____ This course is also proposed as a Liberal Studies Course.

_____ This course is also proposed as an Honors College Course.

_____ Other: (e.g., Women's Studies, Pan-African)

3. Program Proposals

_____ Catalog Description Change _____ Program Revision

_____ New Degree Program _____ Program Title Change _____ Other

_____ New Minor Program _____ New Track

Current program name	*Proposed program name, if changing*

4. Approvals		**Date**
Department Curriculum Committee Chair(s)	Anthropology - Biology	3-22-04
Department Chair(s)		
		4/22/04
College Curriculum Committee Chair		09/10/04
College Dean		8/11/04
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate:		
(include title)		
UWUCC Co-Chairs	Gail Sechrist	10-26-04

* where applicable

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SYLLABUS OF RECORD

I. Catalog Description

SDR 111 Basic Biological Laboratory Operations — 3 class hours, 3 lab hours, 5 credit hours (3c-3l-5cr)

Prerequisites: BIOL 111 or equivalent and permission of instructor and local, state or federal agency/organization authorization.

Level 1 biology describes the characteristics of living organisms and the different levels of biological safety as it applies to microbiology and recombinant DNA laboratories; differentiating between atoms, molecules, elements, and compounds and their importance in biologic systems. Macromolecules and energy generation are discussed. Genetics and biotechnology and the role they play in WMD will be extensively studied.

II. COURSE OBJECTIVES

The students successfully completing this course will be able to

1. Describe the different levels of biologic safety as they apply to they apply to microbiology and recombinant DNA laboratories.

2. Identify the characteristics of life and the criteria used to classify living organisms.

3. Differentiate between atoms, molecules, elements and compounds and discuss their importance in biologic systems.

4. Analyze the importance of macromolecules (biologic molecules) in living systems.

5. Differentiate between prokaryotic and eukaryotic cell structure and function and discuss why these differences are significant.

6. Demonstrate a basic understanding of energy production in cells.

7. Evaluate the importance of genetic information in the living world with special emphasis on WMD.

8. Demonstrate a basic understanding of biotechnology and how it applies to WMD.

III. DETAILED COURSE OUTLINE

Lecture Topics: (42 hours total)

A. Biological Safety (2 Hours)

1) Facility Design
2) Levels of Biologic safety
3) Recommended Biosafety Levels for Infectious Agents

B. Microbial world (2 hours)

1) Bacterial classification and identification
2) Eukaryotic microorganisms: algae, fungi, and protozoa
3) The nature and study of viruses
4) Viruses of animals, humans, and plants

C. Introduction to Life (1 Hour)

1) Overview of Criteria and Characteristics of Life
2) Prokaryotic and Eukaryotic Cell Structure (overview)
3) Functional anatomy of Prokaryotes and Eukaryotes
4) Bacterial Cell wall and unique structures

D. Microscopy Techniques Instruments (2 hours)

1) Compound Microscopes
2) Dark-field Microscopy
3) Fluorescence Microscopy
4) Electron Microscopy

5) Scanning Electron Microscopy
6) Staining techniques procedures involving single dye
7) Differential staining

E. Atoms, Molecules, and Life (1 Hour)

1) Basic Chemistry-atoms, molecules, elements and compounds
2) Chemical Bonding
3) Types of Chemical Reactions
4) Water and the role it plays in the living system
5) Acid, bases and Buffers

F. Biological Molecules (2 Hours)

1) Carbon and the role it plays in biological molecules
2) Synthesis of major macromolecules
3) Structure and Function of Carbohydrates
4) Structure and Function of Lipids
5) Structure and Function of Proteins
6) Structure and Function of Nucleic Acids

G. Cell Structure and Function (2 Hours)

1) Structure and Function of Prokaryotic cells
2) Structure and Function of Eukaryotic cells
3) Comparison of prokaryotic and eukaryotic cells
4) Transport of Materials across the plasma membrane

H. Energy Flow (2 Hours)

1) Structure and Function of Enzymes
2) Enzyme kinetics and mechanism of action
3) Mechanisms of Energy Metabolism
4) Chemiosmosis
5) Respiration under anaerobic conditions
6) Other pathways of glucose degradation

EXAM 1 (1 hour)

I. Dynamics of Bacterial Growth (2 hours)

1) Pure culture methods
2) Measurement of cell growth (mass /weight of the population)
3) Measurement as an increase of cell number
4) Factors influencing cell growth
5) Nutritional aspects of bacterial growth
6) Dynamics of bacterial growth
7) Growth of bacterial colony

J. Informational Macromolecules (4 Hours)

1) Chemistry of DNA and RNA
2) DNA Replication
3) Genetic Code
4) Protein Synthesis
5) Gene regulation

K. Bacterial Genetics (6 hours)

1) Gene alterations (mutations)
2) Mutagenesis
3) Repair of damaged DNA
4) Bacterial excision of damaged DNA and replacement
5) Rates of Mutations
6) Mutant selection
7) Conditional lethal mutants
8) Commercial applications of mutants
9) Mutants and Biological warfare

L. Mechanism of gene transfer (4 hours)

1) Gene transfer between bacteria
2) DNA-mediated transformation
3) Transduction involving viral transfer of DNA
4) Plasmids
5) Transposable elements
6) Restriction modification

7) Applications of Gene transfer

M. Microbiology and Biotechnology (5 Hours)

1) Basic features of Genetic engineering
2) Expression of clone genes
3) Applications of Genetic engineering
   i) Medically important proteins
   ii) Bioremediation involving use of microorganisms
   iii) Toxin production and Biowarfare
   iv) Plant genetic engineering
   v) Vaccine production

N. Polymerase chain Reaction (PCR) (6 hours)

1) Principles of PCR
2) Three-step versus Two-step PCR
3) Application in detection
4) Principles of Real-Time PCR

COMPREHENSIVE FINAL EXAM (2 hours)

Laboratory: (42 hours total)

I. Basic Microscopy (8 hours)

II. Preparation of solutions (2 hours)

III. Enzymes and their action (4 hours)

IV. Aseptic Techniques (6 hours)

V. Basic Molecular Biology Techniques (10 hours)

a) Plating of *E.coli* Cells
b) Preparation of Competent cells
c) Transformation
d) Selection of transformants
e) Data analysis
f) Purification of Plasmid DNA
g) Pipetting

h) Restriction enzyme digestion

i) Gel casting; Gel electrophoresis

j) Mapping

k) Digital documentation

VI. DNA/RNA manipulations (6 hours)

a) Genomic DNA purification/mRNA purification

b) Spectrophotometric analysis/quantifying nucleic acids and determination of purity

VII. Polymerase Chain Reaction (PCR) Laboratories (6 hours)

a) Laboratory experiments with 2-step and 3-step PCR

b) Basic principles of RAPID and hand-on PCR laboratories

IV. EVALUATION METHODS

The final grade will be determined in the following manner:

Written Exams (50%)

There will be two exams in the course. A mid-term during the middle of the semester and a comprehensive final during the finals week. The exams will be a variety of different question types including short answer and essay questions.

Laboratory Component: (25%)

The students will be required to submit laboratory portfolios with all the data carefully analyzed and discussed. The portfolios will be evaluated through out the semester after completion of a specific module. Each portfolio must include experimental observations, analysis, calculations, and conclusions. The portfolio will be evaluated for data collection, analysis, content, data presentation, and writing. The individual laboratory portfolio is expected to demonstrate the author's ability to collect the data, synthesize and interpret results and to think critically about scientific data. In its final

form, the portfolio is to resemble a scientific review article with correct grammar usage, punctuation and spelling as well as scientific terminology.

Capstone Event (25%)

The Capstone event is an equivalent of a term paper performed by the student outside of the regular class hours. The event is a simulation of a real-life incident involving WMD. Students will be evaluated on their ability to assess an incident site for possible unknown biological hazards and conduct a proper response call. The student will apply prior training and education in response to biological incidents. Each student will construct a portfolio that documents his or her response to the capstone event. The format for the portfolio report will be similar to the format used for real incident reports and training reports.

V. Grading Scale:

A-90%-100%; B-80%-89%; C-70%-79%; D-60%-69%; F below 59%

VI. Attendance Policy:

Attendance in both lecture and laboratory is expected of all students in the class. The policy is governed by university rules and regulations. The students are strongly encouraged to attend all classes.

VII. Required Textbook(s), supplementary Books and Readings:

Required Textbook:

Andrew, A.T., Bharathan, N., Bharathan, S. *Weapons of Mass Destruction-Response Element Advanced Laboratory Integrated Training and Indoctrination (WMD-REALITI) Novice Level (Level 1) Biology Lesson Plans.* (Revised November 2003.)

Supplemental Readings:

Campbell, N. A.; Reece, J. B. *Biology*, 6th ed.; Benjamin Cummings: New York.

VIII. Special Resource Requirements:

None

IX. Bibliography

Campbell, N. A.; Reece, J. B. *Biology*, 6th ed.; Benjamin Cummings: New York.

Black, J. *Microbiology: Principles and Applications*, 5th ed.; John Wiley and Sons: New York, 2002.

Fleming, D., Hunt, D., Eds. *Biological Safety: Principles and Practices*, 3rd ed.; ASM Press: Washington, DC, 2000.

Ingraham, J.; Ingraham, C. *Introduction to Microbiology,* 2nd ed.; Wadsworth Publishing Company: Belmont, CA, 2001.

Lewis, R.; et al. *Life,* 4th ed.; McGraw-Hill: New York, 2001.

COURSE ANALYSIS QUESTIONNAIRE

A. Details of the Course

A1. How does this course fit into the programs of the department? For which students is the course designed (majors, students in other majors, liberal studies)? Explain why this content cannot be incorporated into an existing course.

This course is one of the required courses for students in the BS in Natural Science/Science for Disaster Response Track. It is not intended to be a Liberal Studies course. This course is designed for first responders – the emergency personnel who respond to any suspected incident of a chemical, biological, radiological and/or nuclear nature. The content and the intense material coverage are too specific to counterterrorism and first responders to be incorporated into existing courses.

A2. Does this course require changes in the content of existing courses or requirements for a program? If catalog descriptions of other courses or department programs must be changed as a result of the adoption of this course, please submit as separate proposals all other changes in courses and/or program requirements.

This course does not require changes in any other course in the department. A new track (Science for Disaster Response) of the existing program of the BS in Natural Science will include this course among the required courses.

A3. Has this course ever been offered at IUP on a trial basis (e.g. as a special topic). If so, explain the details of the offering (semester/year and number of students).

A pilot of an 11-day WMD-REALITI Chemical, Biological, Radiological and Nuclear Novice Module was conducted for the National Guard and other first responders in the WMD community in October 2003. There were 19 students enrolled in this course. The course received outstanding evaluations from both students and the government personnel present.

A4. Is this course to be a dual-level course? If so, please note that the graduate approval occurs after the undergraduate.

This course is not a dual level course.

A5. If this course may be taken for variable credit, what criteria will be used to relate the credits to the learning experience of each student? Who will make this determination and by what procedures?

This course is not to be taken for variable credit.

A6. Do other higher education institutions currently offer this course? If so, please list examples (institution, course title).

To the best of our knowledge, this course and its intended degree program are unique in the United States. This lack of specific scientific education for emergency first responders at an accredited institution was one of the primary motivating factors for the National Guard Bureau (NGB) to approach IUP to develop this course.

A7. Is the content, or are the skills, of the proposed course recommended or required by a professional society, accrediting authority, law or other external agency? If so, please provide documentation.

The Department of Defense (DoD) Combating Terrorism Technology Support Office (CTTSO) and the Technical Support Working Group (TSWG) appropriated three years of funding for the Weapons of Mass Destruction-Response Element Advanced Laboratory Training and Indoctrination (WMD-REALITI) program. The purpose of this program is to develop an accredited (professional, academic, or both) education, training and research program designed to provide the novice, intermediate, apprentice, and advanced laboratory technicians with knowledge, skills, and abilities (KSA) comparable to those

needed to work in a Chemical Surety, or Biological Safety Level 3 laboratory. The intended audience is the National Guard Bureau's Weapons of Mass Destruction-Civil Support Teams (WMD-CST), other U.S. Government WMD and homeland security response elements, state and local civilian WMD and homeland security response elements, and related emergency planners. IUP was contracted to develop the four modules of courses [Novice (Level 1), Intermediate (Level 2), Apprentice (Level 3), and Advanced (Level 4)] over the three year period of the WMD-REALITI program. This course is part of the Level 1 module. The first year was funded for $170,317, the second year for $441,445, and the third year for $599,777.

B. Interdisciplinary Implications

B1. Will this course be taught by instructors from more than one department or team taught within the department? If so, explain the teaching plan, its rationale, and how the team will adhere to the syllabus of record.

This course will be team taught by three instructors in the Biology and Chemistry Department. The instructor(s) must be associated with the WMD programs at IUP. The course is a combination of lecture and laboratory.

B2. What is the relationship between the content of this course and the content of courses offered by other departments? Summarize your discussions (with other departments) concerning the proposed changes and indicate how any conflicts have been resolved. Please attach relevant memoranda from these departments that clarify their attitudes toward the proposed change(s).

The intended audience of SDR 111 (active first responders in the WMD community) may require intensive delivery and specific educational objectives that are not met by existing IUP courses.

B3. Will this course be cross-listed with other departments? If so, please summarize the department representatives' discussions concerning the course and indicate how consistency will be maintained across departments.

This course is not cross-listed.

B4. Will seats in this course be made available to students in the School of Continuing Education?

Only if the Continuing Education students have been accepted in the SDR program.

C. Implementation

C1. Are faculty resources adequate? If you are not requesting or have not been authorized to hire additional faculty, demonstrate how this course will fit into the schedule(s) of current faculty. What will be taught less frequently or in fewer sections to make this possible? Please specify how preparation and equated workload will be assigned for this course.

Yes, faculty resources are adequate because of external funding. If no external funding is available, then additional faculty resources will be required. This course will be counted as one preparation and six workload hours towards the workload for one faculty member, or as credits split appropriately among the workloads of each of three faculty members who team-teach the course. Each contact hour in laboratories in chemistry, biology, and physics are assigned one (1) workload hour, so 3c + 3l = 6 workload hours. The faculty credentials include possession of a Ph.D. in experimental biological sciences with emphasis in molecular biological techniques and microbiology and a minimum of five years teaching experience, balanced with three to five years of professional work experience in the following areas, skill sets, and certificates. The qualified faculty member will have experience in Bio safety training, immunological techniques, and demonstrated three to five years of conducting training at a facility using biological materials.

C2. What other resources will be needed to teach this course and how adequate are the current resources? If not adequate, what plans exist for achieving adequacy? Reply in terms of the following:

*Space
*Equipment
*Laboratory Supplies and other Consumable Goods
*Library Materials
*Travel Funds

Space: Presently, this degree program is being conducted using the facilities in IUP's science building, Weyandt Hall. However, plans are underway to renovate the second floor of Walsh Hall for the WMD programs. This renovation is scheduled to begin at the end of the Spring 2004 semester. The WMD programs are under the umbrella of IUP's John P. Murtha Institute of Homeland Security. The WMD programs are designated to have space in this building when it is constructed.

Equipment: Specialized equipment has been provided by the DoD through the WMD-REALITI contracts. In the event that contract money is not available to purchase equipment, ESF funds will be used to purchase equipment, or the WMD faculty will write grant proposals for specialized equipment.

Laboratory Supplies: Laboratory supplies have been provided by the DoD through the WMD-REALITI contracts. In the event that contract money is not available to purchase laboratory supplies, funds from the WMD operating budget will be used to purchase the laboratory supplies. This money will be generated from the indirect funds acquired by contracted offerings of the WMD courses or by funds generated by tuition and student fees.

Library: When this course is funded by external money, Concurrent Technologies Corporation (CTC), will package the materials needed by the students. In the event that the course is not funded by external money, students will purchase the

required text at a local copying business. Students may purchase the optional supplemental text at the Co-op Store or online.

Travel Funds: not applicable

C3. Are any of the resources for this course funded by a grant? If so, what provisions have been made to continue support for this course once the grant has expired? (Attach letters of support from Dean, Provost, etc.)

Yes. So far, all resources for this course have been funded by the DoD and the National Guard Bureau (NGB). Contracts with these agencies are expected to continue for several years. However, IUP is preparing to support this course when it is independent of external funding. Additionally, IUP has actively sought and acquired funds for a facility to house the WMD courses.

C4. How frequently do you expect this course to be offered? Is this course particularly designed for or restricted to certain seasonal semesters?

We expect this course to be offered every Spring semester depending on student demand and faculty availability.

C5. How many sections of this course do you anticipate offering in any single semester?

One section will be offered at a time.

C6. How many students do you plan to accommodate in a section of this course? What is the justification for this planned number of students?

A maximum of 24 students can be accommodated in this class in which students do a considerable amount of laboratory work which limits the enrollment.

C7. Does any professional society recommend enrollment limits or parameters for a course of this nature? If they do, please quote from the appropriate documents.

No professional society recommends enrollment limits or parameters for this course. However, the DoD recommends an Instructor to Student ratio of 1:15 and has set the parameters for this course.

C8. If this course is a distance education course, see the Implementation of Distance Education Agreement and the Undergraduate Distance Education Review Form in Appendix D and respond to the questions listed.

This course is not a distance education course.

D. Miscellaneous

Include any additional information valuable to those reviewing this new course proposal.

Justification for 3c, 3l, 5cr:

Typically in the College of Natural Sciences and Mathematics, 4 credits are assigned to a class with 3 hours of class and 3 or 4 hours of lab. That is, usually a lab is valued as 1 credit towards the total course credits. In this course, the lab is valued as 2 credits due to the special nature of the laboratory exercises, which are more intensive in content and require the students to work with more dangerous and/or high-risk materials. Because very little trial and error can be tolerated, students must be better prepared for the laboratory exercises and perform at a higher level. The intensive content and levels of preparation and performance are unlike that for the laboratory exercises in 1 credit laboratory courses. The 5 credits for this course have been acknowledged and approved by the College of Natural Sciences and Mathematics. Please see Appendix A for letter from Ms. Ola Kaniasty, Assistant Dean of the College of Natural Sciences and Mathematics and Chair of the College Curriculum Committee.