New Course Request

Indiana University
South Bend Campus

Check Appropriate Boxes: Undergraduate credit [ ] Graduate credit [ ] Professional credit [ ]

1. School/Division CLAS
2. Academic Subject Code CHEM

3. Course Number N390 (must be cleared with University Enrollment Services)

4. Instructor variable

5. Course Title The Natural World (Variable Title)

Recommended Abbreviation (Optional) (Limited to 52 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Spring 08

7. Credit Hours: Fixed at _________ or Variable from ________ to ________

8. Is this course to be graded SF (only)? Yes [ ] No [x]

9. Is variable title approval being requested? Yes [x] No [ ]

10. Course description (not to exceed 50 words) for Bulletin publication:

   Explores an important scientific or technological issue in modern society. Applies scientific methods and interdisciplinary perspectives in an examination of the subject. Investigates the broader implications and ethical dimensions of scientific research and technological advancement. P One Natural Science (College-Level) course.

11. Lecture Contact Hours: Fixed at _________ or Variable from ________ to ________

12. Non-Lecture Contact Hours: Fixed at _________ or Variable from ________ to ________

13. Estimated enrollment: ________ of which ________ percent are expected to be graduate students.

14. Frequency of scheduling: F, S [x] Will this course be required for majors? No [ ]

15. Justification for new course: satisfies Common Core 300 level course

16. Are the necessary reading materials currently available in the appropriate library? Yes [ ]

17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.

18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant.

19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by:

[Signature] Date 10/30/06

Department Chairman/Division Director

Dean of Graduate School (when required)

Approved by:

[Signature] Date 10/14/06

Chancellor/Vice-President

[Signature] Date

University Enrollment Services

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.
Proposal for
THE NATURAL WORLD
A Common Core course of the IUSB General Education Curriculum

Anderson, Gretchen L.  Department of Chemistry

Course Title: The Natural World – Clinical Biotechnology

First semester to be offered: Fall 2007

A. GENERAL CHARACTERISTICS OF Common Core COURSES

1. How does the course include instruction in at least one of the fundamental literacies (writing, speaking, critical thinking, quantitative reasoning, computer literacy, information literacy, visual literacy?)

   Critical thinking, quantitative reasoning and computer literacy will be addressed primarily in the laboratory component of the course. Students will collect and analyze data from quantitative measurements in the laboratory. They will construct standard curves, both by themselves, and through software associated with spectrophotometers and a variety of point-of-care devices. They will need to critically evaluate their data to see if it is reasonable and meets their preliminary estimates. Since the course has a prerequisite of only one other science course, part of the lab instruction will include appropriate data analysis and comparison to established norms.

   Writing and information literacy will also be included in the course. Students will write a term paper on the clinical biotechnology associated with their choice of a human, plant, or animal disease. As part of the instruction in the course, one full lecture will be devoted to how to find technical information that is written for the non-scientific audience. Advice will also be provided on how to ascertain the credibility of sources without having to resort to the primary literature. Students are then asked to write their term paper modeling an informative article in a newspaper or news magazine (e.g. The New York Times, US News and World Reports, Discover, Science News).

2. In what way is the course interdisciplinary?

   The course is interdisciplinary in that it incorporates everything from basic graphing and statistics to genetic engineering, quality control of pharmaceuticals, development of diagnostic tests for human and plant diseases, forensics, and emergency room issues and diagnostic procedures. It covers a wide range of scientific disciplines, including math, chemistry, biology, molecular biology, biochemistry, materials science. In addition the course brings in issues in criminal justice, health and wellness, and environmental issues, and bases for arguments in ethical debates.
3. What ethical issues will be addressed in the context of course material, and how will the course include instruction in what constitutes ethical and unethical responses to these issues?

Ethical issues covered include ethics involved in genetic engineering of drugs, food, and diagnostic materials. In addition ethics of drug testing and sampling will be discussed. Factors involved in IRB approval and clinical trials will be presented. For these issues, it is not necessarily clear as to what constitutes ethical and unethical responses. Various sides of ethics arguments will be presented, with a detailed scientifically based rationale of positions both for and against the issue, and compromise positions. For example, there are cogent arguments for and against Round-up Ready corn, and the compromise responses practiced by many agriculturalists. These will be discussed in depth. It will be up to each individual student to discern his or her own stance on the issues.
B. SPECIFIC CHARACTERISTICS OF The Natural World

1. Describe the “lab, measurement, observation, or field component” of the course. Students will have a weekly laboratory experience that will demonstrate state-of-the-art issues in measurement and diagnostics in clinical biotechnology. Students will begin by becoming familiar with specialized measuring techniques for the extremely small quantities used in clinical biotechnology (accurate measurement of microliter volumes, nanograms of biologically active molecules, and differences in light absorption that the eye cannot detect). Graphical analyses, both constructed manually (standard curves etc.), and through use of spreadsheets and specialized instrument-associated software will introduce students to various ways of quantification. The concept of standard curve versus single point standard versus simple quantification by extinction coefficient will be stressed. Labs will often consist of samples that mimic clinical samples (no samples of human origin will be used), and students must correctly measure minute components of complex mixtures that simulate analyses of a single component of blood.

In addition, students will be practicing observation and trouble-shooting of results. The use of control samples will be stressed and always used for comparison. Electrophoresis, cloning of genes, fingerprinting, etc., are based on careful observation of data and skill in discerning what information to look for. The ramifications of careful observation and data analysis in health related fields and forensics will be stressed.

A “field component” includes a field trip to the South Bend Medical Foundation to observe how clinical tests and forensics are utilized on a large scale in hospital and clinical settings.

2. How will the aspects of historical development and social context of the content be addressed?

Although the course will focus on current uses of diagnostic technology, some historical aspects will be discussed. For example, during discussion of the use of antibodies in precise detection of picomolar concentrations of analytes of importance the requirement for antibodies in the human body will be discussed with mention of the European smallpox epidemic and the introduction of vaccines David the “bubble boy” and the analysis of his immune system (Severe combined immunity disease – SCIDs) that occurred in local South Bend laboratories. The development of immunoassays in 1975 and the revolution in medical diagnostics that ensued will be discussed, as will the historical context of antibiotics and vaccines and their profound effect on world-wide health, longevity and quality of life. There are no references to any history before 1800.

3. Describe how students will be required to find, evaluate, and interpret scientific information.
In addition to finding, evaluating, and interpreting scientific information that the students themselves generate in lab, students will also be required to write a term paper on a human, plant, or animal disease and find literature as to its prevalence, symptoms, diagnosis, treatment, side effects, and other issues. Since much of this information is somewhat technical (e.g. diagnosis and treatment), a full lecture is devoted to how to find reliable technical information that the layperson can understand and interpret.

4. Describe how the course will help students to understand what constitutes a scientific approach to problems and the nature of proof.
The scientific approach will be covered in various lectures during discussion of development and second and third generation diagnostic procedures and point-of-care devices, as well as a lecture specifically addressing precision and accuracy in scientific measurements, appropriate statistical analyses and comparisons to in-house standards as well as national and international control samples. Quality Analysis and Quality Control issues will be discussed in detail.
In the laboratory, controls, standards, and/or molecular weight markers will be used by the students in every lab.

5. How will the course illustrate connections between topics and emphasize the application of scientific principles to new situations or current events?
The course is both tightly and loosely interwoven to provide various connections among both topics and disciplines. All of these will be applied to current uses of biotechnology and clinical biotechnology. The laboratory component will allow students to use kits and instrumentation that are currently the standard of diagnostics used in clinics and industry. Virtually everything is related to current events and current practices.

6. How will the course introduce students to the concept of change in the physical world?
One could define biotechnology and the chemistry underlying it as changes in the physical world. Students will learn a variety of ways to detect myriad compounds that our eyes and other senses cannot. By using scientific, physical, chemical, and biological tools, they will learn how a single component of interest in a complex mixture and be detected and quantified.
<table>
<thead>
<tr>
<th>Lecture</th>
<th>Laboratory</th>
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<tbody>
<tr>
<td>Introduction (DC) - clinical biotechnology as a science; instrumentation; safety; etc.</td>
<td>Calibration of pipette men, construction of standard curves</td>
</tr>
<tr>
<td>Atoms &amp; Molecules (GA) - electrons; electronegativity; bonds (ionic &amp; covalent); etc.</td>
<td>Models and computer graphics; computer models of proteins and drug binding</td>
</tr>
<tr>
<td>Principles of measurement (KG) - accuracy &amp; precision; data reporting; QA &amp; QC; etc.</td>
<td>Glucose oxidase; spectrophotometric detection</td>
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<tr>
<td>Guest Lecturer - Professor Peter Bushnell - circulatory &amp; urinary systems; blood cells; transport</td>
<td>Blood analysis; hematocrit (e’fuge and electronic)</td>
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<tr>
<td>Proteins &amp; Enzymes (GA) - structure &amp; function of proteins &amp; enzymes; antibodies; spectrophoto.</td>
<td>iSTAT multi-component analysis</td>
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<tr>
<td>Methods of detection (DC) - detecting enzymes etc. using antibodies etc. ELISA</td>
<td>ELISA - diagnosis of viral disease qualitative &amp; quantitative assays</td>
</tr>
<tr>
<td>Layman’s scientific literature (DC) - getting the information you need at an understandable level - paper</td>
<td>Mid Term - Exam 1</td>
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<tr>
<td>Methods of Separation (KG) - LC, PC, GC, electrophoresis for proteins; etc.</td>
<td>Identification of isoenzymes by gel electrophoresis (peroxidase)</td>
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<tr>
<td>Guest Lecturer - Mike Morris - enzyme purification &amp; assay kit production; business perspectives</td>
<td>Blood coagulation and AC - use of ACT (Actalyke &amp; I-STAT); heparin curve to 3 U/mL</td>
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<tr>
<td>Field Trip - SBMF</td>
<td>NA</td>
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<tr>
<td>Guest Lecturer - Kirk Mecklenburg - DNA fingerprinting</td>
<td>Cloning expt. – firefly gene into E. coli</td>
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<tr>
<td>Guest Lecturer - Marty Gersey - forensic chemistry; traditional fingerprinting; etc.</td>
<td>Detection at crime scenes and in the laboratory</td>
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<tr>
<td>Guest Lecturer - Mark Walsh - emergency room medicine; point of care testing; clinical diagnosis</td>
<td>Certification in Bloodborne Pathogens; American Red Cross</td>
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<tr>
<td>Guest Lecturer - David Pearman - Careers in Clinical Biotechnology; - tech. sales (corporate downsizing??)</td>
<td>Finding careers in clinical biotechnology; use of computer &amp; internet; etc.</td>
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<tr>
<td>Final Exam</td>
<td>NA</td>
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