



## Proposal for New Course

1. New course effective beginning what term and year? (ex. Spring 2004, Summer 2005) Fall 2005

2. College Engineering and Natural Sciences 3. Academic Unit (Department) Biological Sciences

4. Course subject/catalog number BIO 376 5. Units (credit hours) 4

6. Co-convened with \_\_\_\_\_  
(Must be approved by UGC prior to bringing to UCC. Both course syllabi must be presented)

7. Cross-listed with \_\_\_\_\_  
(Must be approved by UGC prior to bringing to UCC. Both course syllabi must be presented.)

8. Long course title Industrial Microbiology and Biotechnology

9. Short course title (maximum of 30 characters including spaces) Biotechnology

10. Catalog course description (20-30 words), include requisites.

**Industrial Microbiology and Biotechnology explores how microorganisms are used to make medicines, foods, and energy, and to genetically engineer plants and animals.**

**Prerequisites: CHM 151 and BIO 205**

11. Grading option: Letter grade X or pass/fail \_\_\_\_\_ or both \_\_\_\_\_ (If both, the course may only be offered one way for each respective section.)

12. May course be repeated for *additional* units (credit hours)? yes \_\_\_\_\_ no X If yes, maximum units allowed? \_\_\_\_\_

13. If yes, may course be repeated for additional units (credit hours) in the same term? (ex. BIO 300) yes \_\_\_\_\_ no \_\_\_\_\_

14. Is this a topics course? yes \_\_\_\_\_ no X

15. Please check **ONE** of the following that most appropriately describes the course:

Lecture and lab (combined) X Lecture only \_\_\_\_\_ Lab only \_\_\_\_\_ Clinical \_\_\_\_\_ Research \_\_\_\_\_  
Seminar \_\_\_\_\_ Field Studies \_\_\_\_\_ Independent Study \_\_\_\_\_ Activity \_\_\_\_\_ Supervision \_\_\_\_\_

16. Contact hours of lecture weekly 3 hours lecture Contact hours of lab weekly 3 hours lab

17. Prerequisites (must be completed before proposed course) CHM 151, BIO 205

18. Corequisites (must be completed with proposed course) \_\_\_\_\_

19. If course has no requisites, will all sections of the course require (check one):  
instructor consent \_\_\_\_\_ department consent \_\_\_\_\_ no consent \_\_\_\_\_

20. Is the course needed for a new degree plan? yes \_\_\_\_\_ no X For inclusion as elective in modified emphasis area within existing Microbiology BS program  
If yes, has the program been approved by UCC or UGC? yes \_\_\_\_\_ no \_\_\_\_\_  
If yes, when? \_\_\_\_\_  
Name of new program plan? \_\_\_\_\_

21. Does course replace an existing course? yes \_\_\_\_\_ no X  
If yes, what course? \_\_\_\_\_ **Submit Proposal for Course Change or Deletion for replaced course.**

22. Does course duplicate content of existing courses within or outside of your college? yes \_\_\_\_\_ No X  
If yes, list any courses this course may have duplicative material with and estimate percentage of duplication:

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*Please attach letters of support from each department who course is listed above.*

23. Will this course affect other academic plans, academic units (departments), or enrollment? yes \_\_\_\_\_ no X  
If yes, explain in justification and provide supporting documentation from the affected departments.

24. Is a potential equivalent course offered at a community college (lower division only)? yes \_\_\_\_\_ no X  
If yes, does it require listing in the *Course Equivalency Guide*? yes \_\_\_\_\_ no \_\_\_\_\_  
Please list, if known, the institution, subject/catalog number of the course. \_\_\_\_\_

25. Justification for new course, including unique features if applicable. (Attach proposed syllabus in the approved university format; see next page for outline.)

**Human society has manipulated microorganisms for thousands of years. Historical examples include fermentation technology yielding beverages and food products. This manipulation has expanded dramatically in recent decades, accelerated by the availability of molecular techniques to genetic engineering and an ever-increasing list of problems that may be addressed through microbial activity. Students pursuing a BS degree in Microbiology following the newly proposed Applied and Environmental Microbiology emphasis area will receive excellent preparation for productive careers or graduate study. The field of applied and environmental microbiology is extremely broad, yet highly technical and requires detailed training in fundamental microbiology and application of basic principles to real world situations. This course will focus on real world applications, integrating information from a variety of fields (biochemistry, molecular biology, fundamental microbiology, microbial physiology, etc.) to explore in detail the many ways in which microorganisms can be used for human benefit. Current examples include using microorganisms for genetic modification of plants and animals to increase growth, productivity, and resistance to disease. Fermentation and reactor technologies, yielding a wide variety of food products, chemical feedstocks, and alternative energy sources, will also be discussed in detail. Students who successfully complete this course will have an appreciation for how microbiological principles can be used for the betterment of society and the enormous potential for future growth in these industries.**

**In order to stimulate critical thinking, reading and writing skills, an important component of the course will be guided discussions of current literature and detailed writing assignments.**

26. Names of current faculty qualified to teach this course Egbert Schwartz

27. If course will require additional faculty, space, or equipment, how will these requirements be satisfied?  
**No additional faculty, space or equipment will be required to deliver this course.**

28. Will present library holdings support this course? yes X no \_\_\_\_\_

## 29. Approvals

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Department Chair (if appropriate)

Date

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Chair of college curriculum committee

Date

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Dean of college

Date

### For Committee use only

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For University Curriculum Committee  
Or University Graduate Committee

Date

Action taken:

\_\_\_\_\_ Approved as submitted

\_\_\_\_\_ Approved as modified

*Note: Submit original to associate provost's office. That office will provide copies to college dean, department chair, registrar's office, and Academic Information Office after approval*

## COURSE SYLLABUS – BIO 376

### General Information

- Name of college and department  
College of Engineering and Natural Sciences  
Department of Biological Sciences
- Course prefix, number, and title  
BIO 376 Industrial Microbiology and Biotechnology
- Semester in which course will be offered  
Fall 2005
- Clock hours, credit hours  
4 credit hours
- Instructor's name  
Egbert Schwartz
- Office address  
Room 250, Biology building (#21)
- Office hours  
To be determined

### Course prerequisites

BIO 181 and BIO 205

### Course description

The course Industrial Microbiology and Biotechnology explores how microorganisms are used in industry to make medicines, foods, and energy and how microorganisms are used to genetically engineer plants and animals.

### Student Learning Expectations/Outcomes for this Course

Upon completion of this course students will understand how microorganisms are used in wide variety of industries. Students will have obtained hands on experience in using microorganisms to make valuable products.

### Course structure/approach

The course will consist of three hours of lecture and three hours of lab each week.

### Textbook and required materials

Industrial Microbiology: An Introduction, by Michael J. Waites, Blackwell Publishers.  
ISBN: 0632053070.

### Recommended optional materials/references (attach reading list)

Understanding Biotechnology, by Aluizio Borem, Fabricio R. Santos, David E. Bowen,  
Prentice Hall PTR; ISBN: 0131010115.

## **Course outline**

The following lecture topics will be discussed:

### **Introduction and review:**

- Introduction to industrial microbiology
- Microbial metabolism
- Microbial genetics
- Industrial microorganisms

### **Introduction of microbial industrial processes.**

- Microbial enzymes
- Fuels and industrial chemicals
- Health care products
- Food and beverage fermentation
- Food additives and supplements
- Microbial biomass production

### **Growing microorganisms in industrial applications:**

- Microbial growth and nutrition
- Fermentation media
- Fermentation systems

### **Down stream processing**

- Microbial enzymes
- Fuels and industrial chemicals
- Health care products
- Food additives and supplements

### **Microorganisms and biotechnology**

- History of biotechnology
- Genetic engineering
- Using microorganisms to alter the genomes of plants or animals
- Biotechnological products
  - Transgenics in agriculture
  - Making medicines with transgenics.

### **The following laboratory exercises will be completed:**

- Effect of nutrition, temperature and oxygen on microbial growth
- Yeast and bread
- Making yoghurt
- Transforming bacteria with a green fluorescent protein
- Isolating green fluorescent protein from genetically engineered bacteria
- Infecting plant cells with agrobacterium
- Extraction of DNA from infected plants
- Isolating antibiotic producing bacteria/fungi from the environment.
- Studying the effect of nutrition and temperature on antibiotic production.

Detecting the insulin gene in the human genome.  
Effect of fermentation media on bacterial growth  
Design of fermentation system  
Microbial fuel cells  
Generating methane with archaea

### **Assessment of Student Learning Outcomes**

- **Methods of Assessment**  
There will be three exams and a final. The final will cover all material from the class. Together they represent 75% of your grade. The other 25% of your grade will depend on 5 quizzes (5% each) that cover material discussed during the lab exercises.
- **Timeline for Assessment**  
There will be an exam every 5 weeks. The final will be taken during final exam week. Lab quizzes will be administered every three weeks

### **Grading System**

Your grade will be calculated as follows:

Exam I	15 %
Exam II	15 %
Exam III	15 %
Final Exam	30 %
LabGrade	25 %

Your letter grade will be calculated based on your final percentage grade in the course as follows:

A = 90% - 100%
B = 80% - 89.999%
C = 70% - 79.999%
D = 60% - 69.999%

### **Course policy**

- **Retests/makeup tests**  
You will need to make special arrangements with me if you want to take the test at another time. You will need a valid excuse such as a medical emergency or religious holiday.
- **Attendance**  
Attendance will not be taken during lectures but is required for lab periods. In order to achieve a high grade in this course it is highly recommended that you do attend lecture.
- **Statement on plagiarism and cheating**

Here is the policy: DON'T! Cases of plagiarism or cheating will be dealt with through official channels at the university. The complete policy on academic integrity is in Appendix F of NAU's Student Handbook.

**University policies:** There are a number of university policies that all students should be aware of. You will find them at this url: <http://www.cet.nau.edu/~apr/policies.html>

At this website you will find policies on:

- Safe Working and Learning Environment
- Students With Disabilities
- Accommodation of Religious Observance And Practice
- Institutional Review Board (And Use Of Human Subjects)
- Academic Dishonesty
- Medical Insurance Coverage For Students
- Classroom Management
- Evacuation Policies