



UNIVERSITÀ  
CATTOLICA  
del Sacro Cuore



**Ramon Llull University, IQS School of Management - Barcelona  
Catholic University of the Sacred Heart - Milan  
Franklin University Switzerland - Lugano  
Forum-Nexus Program  
Undergraduate Division**

**Course Syllabus**

**BIO 491-SIS  
Innovations in Biotechnology Research in Europe**

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**Course Description**

Biotechnology is a broad discipline combining biological processes and technology. New tools and products are being developed every day to contribute to this growing field, and research initiatives continue to expand. Europe is home to a plethora of global organizations committed to reaching new heights in biotechnology innovation.

This Supervised Independent Study (SIS) course will guide students through the basic principles of biotechnology research and take an in-depth look at innovations happening in Europe, while providing the opportunity for an independent exploration of the subject.

**Course Objectives**

Upon successful completion of this course, students will be able to:

1. Develop an understanding of biotechnology
2. Explain various aspects and subsets of biotechnology, such as bioproducts, microbial fermentations, and genetic engineering
3. Identify best practices in research methods
4. Describe the characteristics of the biotechnology research in Europe in general, and in England, France, the Netherlands, Germany, Italy, and Greece
5. Describe key organizations related to biotechnology research in Europe
6. Identify future challenges and opportunities facing the biotechnology industry in Europe

**Course Requirements**

This course requires independent research, organization, and academic discipline. Students are expected to complete the required and additional readings in pace with their assignments and the course outline. Students will meet with their SIS Coordinator regularly throughout the course for consultation and assistance. There will be an oral presentation, a midterm exam, a final exam, and five essay assignments.

**Essay #1 (minimum length: 1,000 words)**

- What is biotechnology?

- What are the primary industries related to biotechnology?
- What in particular is unique about biotechnology research in Europe? What are the primary organizations and corporations contributing to this research?

**Essay #2 (minimum length: 1,000 words)**

- Analyze the following with respect to England:
  - Development of biotechnology and research initiatives
  - Primary organizations contributing to biotechnology research
  - Cultural characteristics/influences
  - Main innovations within the past 5-10 years
  - Future of biotechnology research

Prepare a reflection essay on the aspects you have reviewed and analyzed. Summarize what you have found through your research, and what you've perceived during your time in England.

**Essay #3 (minimum length: 1,000 words)**

- Analyze the following with respect to France:
  - Development of biotechnology and research initiatives
  - Primary organizations contributing to biotechnology research
  - Cultural characteristics/influences
  - Main innovations within the past 5-10 years
  - Future of biotechnology research

Prepare a reflection essay on the aspects you have reviewed and analyzed. Summarize what you have found through your research, and what you've perceived during your time in France.

**Essay #4 (minimum length: 1,000 words)**

- Analyze the following with respect to Germany:
  - Development of biotechnology and research initiatives
  - Primary organizations contributing to biotechnology research
  - Cultural characteristics/influences
  - Main innovations within the past 5-10 years
  - Future of biotechnology research

Prepare a reflection essay on the aspects you have reviewed and analyzed. Summarize what you have found through your research, and what you've perceived during your time in Germany.

**Essay #5 (minimum length: 1,000 words)**

- Analyze the following with respect to Italy:
  - Development of biotechnology and research initiatives
  - Primary organizations contributing to biotechnology research
  - Cultural characteristics/influences
  - Main innovations within the past 5-10 years
  - Future of biotechnology research

Prepare a reflection essay on the aspects you have reviewed and analyzed. Summarize what you have found through your research, and what you've perceived during your time in Italy.

**Presentation**

Deliver a 15-minute PowerPoint presentation summarizing the main findings of your independent study.

Required components include:

- Summary of your goals and objectives
- Overview of biotechnology research in Europe
- Findings as they apply to England
- Findings as they apply to France
- Findings as they apply to Germany
- Findings as they apply to Italy
- Reflection on what you've learned through the SIS course

### **Required Reading**

#### **Modern Biotechnology:**

#### **Connecting Innovations in Microbiology and Biochemistry to Engineering Fundamentals**

by Nathan S. Mosier and Michael R. Ladisch

John Wiley & Sons, 2009

(Kindle Edition recommended)

### **Additional Readings**

Identify 5-10 additional readings (online or printed text) to complement your independent study of innovations in biotechnology research in Europe.

### **Components of Final Grade**

Midterm exam	20%
Final exam	20%
Essay #1	10%
Essay #2	10%
Essay #3	10%
Essay #4	10%
Essay #5	10%
Presentation	10%

### **Grading Scale**

93-100 %	A
90-92.9 %	A-
87-89.9 %	B+
83-86.9 %	B
80-82.9 %	B-
77-79.9 %	C+
73-76.9 %	C
70-72.9 %	C-
67-69.9 %	D+
63-66.9 %	D
60-62.9 %	D-
Below 60 %	F

### **Course Outline**

#### **Module 1: Biotechnology**

- Introduction
- Growth of the Antibiotic/Pharmaceutical Industry

- Growth of the Amino Acid/Acidulant Fermentation Industry

## **Module 2: New Biotechnology**

- Introduction
- Growth of the Biopharmaceutical Industry
- Impacts of the New Biotechnology on Biopharmaceuticals, Genomics, Plant Biotechnology, and Bioproducts

## **Module 3: Innovations in Biotechnology Research in the UK**

- Development of biotechnology and research initiatives
- Primary organizations contributing to biotechnology research
- Cultural characteristics/influences
- Main innovations within the past 5-10 years
- Future of biotechnology research

## **Module 4: Bioproducts and Biofuels**

- Introduction
- Biocatalysis and the Growth of Industrial Enzymes
- Growth of Renewable Resources as a Source of Specialty Products and Industrial Chemicals
- Bioprocess Engineering and Economics
- Bioseparations and Bioprocess Engineering

## **Module 5: Innovations in Biotechnology Research in France**

- Development of biotechnology and research initiatives
- Primary organizations contributing to biotechnology research
- Cultural characteristics/influences
- Main innovations within the past 5-10 years
- Future of biotechnology research

## **Module 6: Microbial Fermentations**

- Introduction
- Fermentation Methods
- Microbial Culture Composition and Classification
- Media Components and Their Functions

## **Module 7: Innovations in Biotechnology Research in the Netherlands**

- Development of biotechnology and research initiatives
- Primary organizations contributing to biotechnology research
- Cultural characteristics/influences
- Main innovations within the past 5-10 years
- Future of biotechnology research

## **Module 8: Innovations in Biotechnology Research in Germany**

- Development of biotechnology and research initiatives
- Primary organizations contributing to biotechnology research
- Cultural characteristics/influences
- Main innovations within the past 5-10 years

- Future of biotechnology research

### **Module 9: Modeling and Simulation**

- Introduction
- The Runge-Kutta Method
- Kinetics of Cell Growth
- Simulation of a Batch Ethanol Fermentation
- Luedeking-Piret Model
- Continuous Stirred-Tank Bioreactor
- Batch Fermentor versus Chemostat

### **Module 10: Innovations in Biotechnology Research in Italy**

- Development of biotechnology and research initiatives
- Primary organizations contributing to biotechnology research
- Cultural characteristics/influences
- Main innovations within the past 5-10 years
- Future of biotechnology research

### **Module 11: Enzymes**

- Introduction
- Enzymes and Systems Biology
- Industrial Enzymes
- Enzymes: In Vivo and In Vitro
- Fundamental Properties of Enzymes
- Classification of Enzymes
- Sales and Applications of Immobilized Enzymes
- Assaying Enzymatic Activity
- Batch Reactions
- Thermal Enzyme Deactivation

### **Module 12: Innovations in Biotechnology Research in Greece**

- Development of biotechnology and research initiatives
- Primary organizations contributing to biotechnology research
- Cultural characteristics/influences
- Main innovations within the past 5-10 years
- Future of biotechnology research

### **Module 13: Genetic Engineering: DNA, RNA, and Genes**

- Introduction
- DNA and RNA
- Genes and Proteins

### **Academic Integrity**

Ramon Llull University, Franklin University Switzerland, and the Catholic University of the Sacred Heart place a high value on the integrity, good conduct, and academic honesty of all students. Students are

expected to maintain high standards of academic integrity at all times. Any instance of academic dishonesty, including plagiarism, will result in a grade of F for the course.