Fall 2015 - Bio2010: The Science of Biotechnology (3 credits)

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Course Description: Biotechnology is truly interdisciplinary with a myriad of pieces from biology, chemistry, engineering, physics, computer sciences, management, public policy, and law that apply the scientific process to societal challenges. This course introduces topics for science and engineering majors with an interest in biotech and teaches scientific concepts to business students considering careers in biotech management and entrepreneurship. Students completing Bio2010 will understand key science concepts, how discoveries lead to applications addressing global challenges, effectively use a variety of resources to explore connections between science and biotech business, synthesize information from different fields, exhibit strong teamwork skills, and communicate information in written and oral forms. This course also provides a gateway for students interested in the two-year Biotech Explorers Program (BEP). The first two weeks of the course will introduce students to the history of biotechnology, the BEP, and the use of case studies. The remainder of the course uses a series of four 3-week units that combine lecture material, in-class group assignments, and readings to introduce the science and scope of biotechnology. For each unit, student teams will also develop short case studies of St. Louis biotech companies and present their findings to the class. A series of site-visits will introduce students to the vibrant St. Louis biotech community. Limited to 20 students.

Course Time: Tuesday and Thursday 3:30-5:00; Life Science 310

Course Website: Information about the course can be accessed on Blackboard. This website will also be used for the posting of problem sets and pdfs of reading assignments.

Academic Integrity Policy: This course will be governed by the Washington University policy on academic integrity. All students should review the policy at the following website: http://www.wustl.edu/policies/undergraduate-academic-integrity.html
Violations will be reported to the academic integrity officer of Arts and Sciences.

Student Evaluation: A combination of in-class exercises, written case studies, in-class presentations, participation, and field trip summaries will be used to evaluate student-learning outcomes.

| In-Class exercises: 8 x 10 pts | 80 pts |
| Case Studies: 4 x 50 pts | 200 pts |
| Participation | 70 pts |
| Field Trip Summaries 4 x 25 pts | 100 pts |

450 pts
Course Schedule

Week 1: Introduction Aug 25 & 27
The goals of this week are to introduce the BEP and Bio2010, to provide a short history of biotechnology, and engage in team building exercises. Students will complete a pre-test that surveys their understanding of key science concepts, knowledge of the biotech industry, and understanding of global challenges. Assessment Survey and CURE survey: http://biology4.wustl.edu/bio2010

Week 2: Case Study Practice Sep 1 & 3
The use of case studies as a student-led peer-learning tool will be introduced. A modified, short 4-5-page case study format will be used for Bio2010. This format focuses on science, not financials, by profiling a representative biotech company using four components, as follows:
  i) the basic science used by the company;
  ii) how that science led to new products or technologies;
  iii) how the company applies that product to a problem, and
  iv) evaluation of the company's potential impact.
In this week, students will be given an example case study, work through how the example was generated, discuss the steps in that process, and summarize the study in a short presentation.

Weeks 3-5: Unit 1 - Pathways - Transformations of Energy & Matter
Sep 8 The Original Biotechnology: Fermentation & Metabolism
Sep 10 Biofuels/Biomaterials, Energy Systems, Production Platforms
Sep 15 & 17 Case Studies - Akermin, Benson Hill, Conagen, Elemental Enzymes
Sep 22 Group Presentations
Sep 24 Site Visit - National Corn to Ethanol Center

Weeks 6-8: Unit 2 - Structure & Function
Sep 28 Proteins: Hitting an Å-Wide Target
Oct 1 Pharmaceuticals & Therapeutics
Oct 6 & 8 Case Studies - Sequoia Sciences, Mallinckrodt, Tripos/Certara
Oct 13 Group Presentations
Oct 16 Site Visit - Sequoia Sciences

Weeks 9-11: Unit 3 - Information Flow, Exchange, & Storage
Oct 20 ATGC: From Genes to Genomes
Oct 22 Personalized Medicine & Diagnostics
Oct 27 & 29 Case Studies - MOGene, EMD, BacterioScan
Nov 3 Group Presentations
Nov 5 Site Visit - McDonnell Genome Institute at WUST

Weeks 12-14: Unit 4 - Systems & Interconnections
Nov 10 Plants - Food, Fuel, & Fiber
Nov 12 Agriculture, Plant Biotechnology, & Sustainability
Nov 17 & 19 Case Studies - Monsanto, Solae, NewLeaf, KWS
Dec 1 Group Presentations
Dec 3 Site Visit - Monsanto
Overview of 3-Week Units. Each 3-week unit in Bio2010 focuses on a science concept and begins with a week that introduces the scientific background for an area of biotech and the major challenges in that area. Topics for each unit will be supported by specific reading assignments drawn from primary literature accessible to freshman and an in-class problem set emphasizing quantitative skills.

In the second week of a unit, each student team will pick a St. Louis company related to the science concept of the unit for a case study. The St. Louis area has an active biotech-related community with companies engaged in the development and production of medicines, agricultural chemicals, plant biotech, chemical manufacturing, medical equipment manufacturing, and research and development (www.stlrega.org). In particular, companies at the BioResearch & Development (BRDG) Park and Center for Emerging Technologies (CET), which are innovation clusters and start-up incubators, provide a source of material for the course.

The case study is a student-driven active learning experience. Each student on a team will research one of the four case study questions (i.e., science, product, problem, impact). These case study assignments will rotate between students in each unit, so that each student will research and write about one of these questions during the semester. Class time will be dedicated as resource time to help students with questions and to guide them in their research of the company. Each team will synthesize their findings as written document that will serve as the basis for an in-class presentation during the first session of the third week.

The last week of a unit begins with student presentations (10 min) on the key science, product, problem, and impact followed by class discussion. This week will also include a site visit to show students where the science happens using tours of St. Louis biotech opportunities within easy reach of campus. Students will write a short summary of the visit, what they learned and observed, and how the visit helped demonstrate the application of science to a biotech problem.