Career Preparation Through Multidisciplinary Education: A Multidisciplinary Bioprocessing Laboratory (MBL) Course

**Introduction**

- Multidisciplinary teams allow a broad range of expertise to be applied to complex problems, but require effective communication across disciplinary boundaries.
- Conventional educational models do not provide interaction between students of diverse disciplines.
- New educational programs are needed to teach students skills for multidisciplinary teamwork.

**Examples of Student Research**

**Optimization of Enzyme Reaction Utilizing Colloidal Liquid Aphrons**

- To determine the optimum reaction conditions for the hydrolysis of p-nitrophenyl caprylate (pnp-caprylate) with lipase
- Optimize the enzyme reaction rate by using colloidal liquid aphrons to increase interfacial surface area available for substrate-enzyme interaction
- Model a reaction rate equation to the system and determine the parameters of the equation
- Teach students to perform research efficiently in a multidisciplinary-team environment.

**Malolactic Fermentation in Cherry Juice by a Genetically Engineered Strain of Oenococcus oeni**

- To obtain and characterize a strain of Oenococcus oeni capable of heterolactic fermentation
- Perform large-scale fermentation to characterize yields of ethanol and lactic acid
- Introduce students to bacterial fermentation as a method for creating bio-based products
- Improve students problem-solving abilities through a multidisciplinary approach

**Course Structure**

**MBL Student Enrollment**

- 1999
  - eleven students
  - six disciplines (CHE, BOT, BCR, CEM, MIC, PSL)
- 2000
  - eleven students
  - four disciplines (CHE, ZOO, BCH, MIC)
- *2001
  - required for MSU graduate training program
  - Multidisciplinary Graduate Training Program in Technologies for a Bio-Based Economy
  - Professional M.S. Degree (MSU Microbiology Dept.)
  - effort to cross-list course in science departments

**Expected Industrial Benefits**

- Graduates who are valued by the pharmaceutical industry
- Graduates who can solve multidisciplinary problems
- Graduates who function effectively in multidisciplinary teams
- Graduates who are able to plan and manage complex projects
- Graduates trained in advanced research methods

**Purpose of MBL Course**

- The purpose is to enable students to:
  - function effectively in a multidisciplinary team
  - solve a biotechnological research problem
  - conduct experiments in a multidisciplinary lab
  - be proficient in advanced research methods
  - exercise project management skills
  - communicate well in interdisciplinary settings
  - efficiently use technical resources/databases

**In-Class Training Exercises**

- Teams practice creative problem solving
  - lecture, handouts on creativity/problem solving
  - presented realistic, complex problem
  - multidisciplinary teams develop solutions

- Teams prepare oral and written reports
  - lecture, handouts on effective communication
  - two team oral presentations (videotaped)
  - final team written report on research project

- Industrial speakers cover additional topics
  - “Multidisciplinary Teams in the Pharmaceutical Industry” (Dr. John Shabashnig of Pharmacia)