Improving Undergraduate Education Through Innovative Research Experiences

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Outline

- CSUF
- Department of Chemistry & Biochemistry
- Research experiences
  - Traditional undergraduate research
  - Integrated research and teaching
  - Internships
  - Outreach
California State University Fullerton

- 40,235 students enrolled in Fall 2016
- Designated as an Hispanic Serving Institution
  - ~40% of the student body underrepresented minority
- Programs that support undergraduate research
  - Louis Stokes Alliance for Minority Participation (LSAMP)
  - Minority Access to Research Careers (MARC)
  - Regional Alliance in STEM Education (RAISE)
  - Howard Hughes Medical Institute (HHMI)
Department of Chemistry & Biochemistry

- 3 types of undergraduate degrees
  - BS Chemistry, BA Chemistry and BS Biochemistry
- M.S program
- 667 majors in Fall 2017
- Faculty manage year-round active research laboratories with undergraduate students
  - Research group sizes can be 5-20 students
  - Organic, analytical, biochemistry, inorganic, computational, physical, inorganic and chemical education
- Faculty members are also academic advisors
Safety at CSUF

- All researchers are required to attend safety training
  - Biosafety
  - Hazardous Communication
  - Hazardous Waste
  - Fire Safety
  - Autoclave Operations
  - Compressed Gases
  - Eye Wash/Safety Shower Operations
- Inside the research laboratories
  - Laboratory chemical hygiene plan
  - Documented training of all researchers
  - SOP for all equipment

June 5
8:00-12:00PM
MH-287

June 1
8:00-12:00PM
MH-285

May 20
8:00-12:00PM
MH-287

July 2
8:00-12:00PM
MH-47
Research is a positive experience

- CSUF maintains a strong culture of undergraduate research
- Students learn about scientific research
- Provides students with support from both peers and faculty mentors
- Improves critical thinking and problem solving skills
- Helps students succeed in both academics and future careers
Traditional undergraduate research

- Students work a minimum of 2 semesters to earn 3 units of research credit, required for graduation
- Students will present a poster and write a thesis at the end of their research experience
- 2016-2017 academic year
  - 250 undergraduate students participate in research
Salzameda research laboratory

- Synthesize, screen and optimize small molecule inhibitors for enzymes related to human health and disease
  - Botulinum neurotoxin
  - West Nile virus
  - Chagas disease
Salzameda research laboratory

- Students gain skills in medicinal chemistry
  - Organic synthesis
  - Enzymatic assays
  - Molecular modeling
- Present posters at scientific
- Publish peer-reviewed manuscripts

- After graduation (15 students)
  - Industry (4 students)
  - Health professions (1 student)
  - Graduate school (8 students)
Integrated research and teaching

- **Advances in Biotechnology (CHEM472B)**
  - Students are exposed to scientific questions and use primary literature to design and test a hypothesis leading to novel scientific data
  - Students work under the guidance of a faculty member on a topic related to their research

- **Sustainability Projects (CHEM492/ENST492)**
  - Students work in teams to solve real world sustainability projects on campus or in the community

- **Medicinal chemistry laboratory (in development)**
  - Students will synthesize, screen and identify novel molecules that inhibit enzymes related to human health and disease
Internships

- Students work in industrial or academic laboratories to gain experience and new technical skills
  - Required to work 270 hours for 3 units of credit
  - Students will give a presentation and write a review on their internship experiences
  - Currently students are working in cosmetic, brewery, quality control and pharmaceutical industries
Weekend research experience

- Provide an authentic research experience for community college and high school students
- Through a competitive application 22 students are selected to participate
- The research is conducted over 3 days
Weekend research experience

- Students worked on creating novel small molecules inhibitors for the West Nile virus NS2B-NS3 protease
- Computational modeling, organic synthesis and enzymatic assays
Weekend Research Experience

- On the last day students meet to discuss their results and what their contribution means to the overall project.
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