What is Biomedical Engineering?

Solving technical problems to improve health

Science
- Chemistry
- Cell Biology
- Physiology
- Physics
& Math!

Engineering
- Targeted creativity with constraints

Medical Applications
- Preventative
- Diagnostics
- Therapeutics
- Enhancement

Engineering Disciplines
- Bioengineering
- Chemical engineering
- Electrical engineering
- Mechanical engineering

Science
- Biology
- Physiology
- Physics

Biology

Medicine

BME

Engineering
A Few of the Exciting Topics in Biomedical Engineering

- Artificial Organs
- Biomechanics
- Prosthetics
- Biotechnology
- Imaging
- Physiological Modeling
- Robotic Surgery
- Biomolecule Design
- Point-of-care Diagnostics
- Systems Biology
- Human Performance
- Neuro-engineering
- Bioinstrumentation
CSU Biomedical Engineering
“BME Plus” = 2 B.S. Degrees

- 5-year B.S. BME + B.S. in
  - Chemical & Biological Engineering
  - Electrical Engineering
    - Laser/Optics Concentration
  - Mechanical Engineering
  - BME Minor
Why two B.S. degrees?

- “One cannot underestimate the flexibility of two B.S. degrees. The BME-plus approach provides the depth of a traditional major with the breadth and specialty in biomedical engineering, and allows students to be better prepared for their careers, qualify for more internships, graduate programs, and job opportunities upon graduation. What student wouldn’t want as many opportunities as possible?”
  - Tara M. Ruttley, PhD, Associate Program Scientist – NASA

- “This BME-plus program will shorten the learning curve, or ramp-up time, when a young engineer joins the ranks of industry, giving the graduating student a leg up both in terms of getting the job, and early success within that job.”
  - Rick Jory, President & CEO, Sandhill Scientific; Chair, Board of Directors, Colorado Bioscience Association

Bureau of Labor Statistics (www.bls.gov/ooh) predicts 27% job growth for BME (19,400 in 2012 ⇒ 24,600 in 2022)
Why two B.S. degrees?

- Employer perspective:
  “I can teach biomedical engineering to an EE, but I can’t teach a BME how to do EE.”

- Student perspective:
  “Partnering the BME degree with CBE was why I came to the university because it combined engineering with medicine and chemistry, my two favorite subjects.”
  – Stephanie Pascua, CSU sophomore, 2016

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BME-Plus
Combined Curriculum Overview

First and Second Years
BIOM 101
Partner Major courses
MATH
CHEM
PH

Third Year
Deeper in Partner Major
Foundations of BME (Cell bio, Physiology, Ochem) and BME Lab
AUCC – ‘General Ed’ Classes

Fourth Year
Wrap up partner major
Transition to BME – BME Gateway classes
AUCC – ‘General Ed’ Classes

Fifth Year
Capstone Senior Design
Technical Electives
AUCC – ‘General Ed’ Classes

Colorado State Univ.
Bachelor of Science in Biomedical Engineering and Bachelor of Science in CBE/EE/MECH Engineering

2 Degrees for 157-158 credits vs. 1 Degree for 125 credits
BME Dual Bachelor’s Degree Curriculum with Electrical Engineering

FIRST YEAR (31 credits)
BIOM 101, Intro to BME
CHEM 111, 112, 113 Chem I,II & Lab
ECE 102, Digital Circuit Logic
ECE 103, DC Circuit Analysis
MATH 160 & 161, Calculus I & II
PH 141, Physics I

SECOND YEAR (31 credits)
LIFE 102, Living Systems
ECE 202, Circuit Theory Appl.
CIVE 262, Eng. Mechanics
CO 150, College Composition
CS 155, 156, 157, Comp. Prog.
MATH 261, Calculus III
MATH 34x, Differential Eq’ns
PH 142, Physics II

THIRD YEAR (30 credits)
LIFE 210, Cell Biology
CHEM 245, Organic Chemistry
BMS 300, Human Physiology
BIOM 300, Biomed. Engr. Lab
ECE 303, Communications
ECE 311 & 312, Linear Systems
ECE 341 & 342, Elec’magnetics
MECH 337, Thermodynamics

FOURTH YEAR (33 credits)
BIOM/ECE 4XX, Gateway
BIOM/ECE Tech. Electives (8 cr.)
ECE 331 & 332, Electronics
ECE 251, Microprocessors
ECON 202, Economics
University Core (3 cr)

FIFTH YEAR (29 credits)
BIOM 486, Design Practicum (8 cr.)
BIOM/ECE Tech. Electives (12 cr.)
CO 301B/JTC 300, Tech. Writing
Univ Core (9 cr.)

Your Name Here

Colorado State Univ.
Bachelor of Science in Biomedical Engineering
and
Bachelor of Science in Electrical Engineering

2 Degrees for 157-158 credits vs.
1 (EE) Degree for 125 credits
2015 Graduate Placement

BME employers: Terumo BCT, Medtronic, Beckman Coulter, Hyde Engineering, Plexus, Spectranetics, Tolmar
Beyond the Classroom: Research and Other Practical Experience

- Strong internship & co-op programs throughout CoE
- Interdisciplinary senior design projects (practicum)
- Research lab opportunities
- Local & global collaborations
  - CSU Vet school allows easy access to animal models
  - Many faculty work w/ UC Denver Health Sci. Center
  - International connections in New Zealand, Germany, Slovenia ...
  - Study Abroad
- Biomedical Engineering Society
  - 9 CSU students received funding to travel to the 2016 annual meeting of BMES in Minneapolis
BME Resources @ CSU

• Faculty – Interdisciplinary school with over 50 faculty throughout 4 colleges
  • Engineering
  • Applied Human Sciences
  • Natural Sciences
  • Veterinary Medicine & Biomedical Sciences

• Physical facilities
  • Main campus – Engineering and Scott Bioengineering
  • Engineering Research Center (West Campus)
  • Veterinary Teaching Hospital/Animal Cancer Center (South Campus)
About Our Students

- 437 students enrolled
  - 46% women
  - 27% nonresidents
  - 21% culturally diverse
  - 14% 1st generation college
  - 22% Honors students
  - High academic performers
    - 4.13 GPA, 1232 SAT, 28.85 ACT (2016 averages)
BME Enrollment @ CSU

BME Enrollment at CSU by Anticipated Graduation Year

MECH cap
- BME+ME cap
- Increases in BME+CBE & BME+EE
Based on students registered as of 8/2/16
ABET Accreditation

• Proudly the first accredited undergraduate biomedical engineering program in the state of Colorado
• Also the first accredited biomedical engineering degree in the country that has an obligatory tie to a partner degree in chemical and biological engineering, electrical engineering, or mechanical engineering.
• ABET is a highly regarded non-governmental organization that allows “students, employers, and the society we serve [to be] confident that a program meets the quality standards that produce graduates prepared to enter a global workforce.” -http://www.abet.org/accreditation/
School of Biomedical Engineering at CSU
www.engr.colostate.edu/sbme

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