Bioengineering: Application of the methods of engineering, physical sciences, and mathematics to solve problems in clinical and life sciences; and use of the principles and techniques of the life sciences in engineering.
3rd Year Curriculum Overview

**FALL**

- MIE301: Kinematics and Dynamics of Machines
- MIE312: Fluid Mechanics I
- MIE342: Circuits with Applications to Mechanical Engineering Systems
- MIE258: Engineering Economics and Accounting
- Natural science requirement: CHE353 Engineering Biology

**WINTER**

- MIE315: Design for the Environment
- MIE313: Heat and Mass Transfer
- MIE334: Numerical Methods I
- Two stream option courses: CHE354 Cellular and Molecular Biology or MIE331 Physiological Control Systems
4th Year Curriculum Overview

FALL
- MIE491: Capstone Design
- Two stream option courses: MIE520 – Biotransport Phenomena
- One Technical Elective
- Other: HSS or CS Elective

WINTER
- MIE491: Capstone Design
- Three Technical Elective courses
- Other: HSS or CS Elective

Biomedical Engineering Minor: 6 courses, some of which are Stream courses
Bioengineering– Core Courses

3F Term – CHE353 – Engineering Biology (req’d)

Quantitative, modelling-based problem solving approach to basic concepts in cell biology and physiology, including cell growth and metabolism, transport across cell membranes, protein structure, homeostasis, nerve conduction and mechanical forces in biology.
# Bioengineering – Core Courses

<table>
<thead>
<tr>
<th>3S Term</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>CHE354</strong></td>
<td><strong>Cellular and Molecular Biology</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MIE331</strong></td>
<td><strong>Physiological Control Systems</strong></td>
</tr>
</tbody>
</table>

**CHE354 – Cellular and Molecular Biology**

Principles of the biochemical and molecular inner workings of the cell. For students interested in environmental microbiology, biomaterials, tissue engineering, and bioprocesses.

**OR**

**MIE331 – Physiological Control Systems**

Linear control theory applied to explain how neuromuscular, cardiovascular, and endocrine systems operate in a healthy human body.
3S Term – MIE331 – Physiological Control Systems
Bioengineering– Core Courses

4F Term – MIE520 – Biotransport Phenomena

Mass transfer, heat transfer, and fluid flow applied to biological systems, including blood and gas flow in organs and organisms.

Flow Speed (cm/s)

<table>
<thead>
<tr>
<th></th>
<th>150</th>
<th>75</th>
<th>0</th>
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</thead>
</table>

![Image of biological system](image.png)
Notable Technical Electives

**MIE439 – Biomechanics**

Application of the principles of solid mechanics, fluid mechanics, and dynamics to cells and organ systems.

**CHE475 – Biocomposites**

Structure, processing and application of natural and biological materials, biomaterials for biomedical applications, and fibre-reinforced eco-composites.

**BME595 – Medical Imaging**

Principles of medical imaging and physics, including magnetic resonance, ultrasound, and x-rays.
Notable Technical Electives

**CHE475 – Biocomposites**
Structure, processing and application of natural and biological materials, biomaterials for biomedical applications, and fibre-reinforced eco-composites.

**MIE439 – Biomechanics**
Application of the principles of solid mechanics, fluid mechanics, and dynamics to cells and organ systems.

**BME595 – Medical Imaging**
Principles of medical imaging and physics, including magnetic resonance, ultrasound, and x-rays.
Bioengineering Opportunities


<table>
<thead>
<tr>
<th>Occupations</th>
<th>Percent change</th>
<th>Number of new jobs (in thousands)</th>
<th>Wages (May 2008 median)</th>
<th>Education/training category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomedical engineers</td>
<td>72</td>
<td>11.6</td>
<td>$77,400</td>
<td>Bachelor's degree</td>
</tr>
<tr>
<td>Network systems and data communications analysts</td>
<td>53</td>
<td>155.8</td>
<td>$71,100</td>
<td>Bachelor's degree</td>
</tr>
<tr>
<td>Athletic trainers</td>
<td>37</td>
<td>6.0</td>
<td>$39,640</td>
<td>Bachelor's degree</td>
</tr>
<tr>
<td>Physical therapist aides</td>
<td>36</td>
<td>16.7</td>
<td>$23,760</td>
<td>Short-term on-the-job training</td>
</tr>
</tbody>
</table>

Job opportunities after graduation:
- Medical device industry
- Biotechnology industry
- Human factors/ergonomics
- Consulting
- Research laboratory
- Graduate school
- Medical school
Questions

• Undergrad office

• Craig Simmons – c.simmons@utoronto.ca

• Other ME faculty in biomedical engineering: Amon, Behdinan, Ben Mrad, Diller, Guenther, James, Liu, Mandelis, Naguib, Nejat, Steinman, Sullivan, Sun, You, Young