INTERDISCIPLINARY ENGINEERING EDUCATION EXEMPLIFIED IN AN INTRODUCTORY BIOMEDICAL ENGINEERING COURSE

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CHALLENGES OF ENGINEERING EDUCATION IN HONG KONG

• Public expectation and norm
• Low learning motivation
• Low popularity of engineering professions
• Decrease in level of preparation of engineers
• Diverse and evolving career opportunities
BIOMEDICAL ENGINEERING
Breadth

Ability to apply knowledge across situations

Depth

Functional / Disciplinary skill
CHALLENGE: HOW TO DELIVER AN INTRODUCTORY BME COURSE
1. Have a general picture of the overall curriculum of the biomedical engineering undergraduate programme, especially on the choice of advanced electives;

2. Build a mathematical, physical, biological and chemical foundation for biomedical engineering;

3. Undertake laboratory using basic techniques in electronics, chemistry, molecular biology, microbiology and electrophysiology to support the study and solution of biomedical engineering problems; and

4. Exhibit good teamwork skills and serve as effective members of multidisciplinary project teams.
<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture content</th>
<th>Thematic Unit</th>
</tr>
</thead>
</table>
| 1    | Introduction to BME  
Physiology and anatomy  
Central dogma of molecular biology |  
**Molecules to Organs** |
| 2    | Molecular engineering  
Bioinformatics |  
**Bio-instrumentation** |
| 3    | Cell engineering  
Computational cell biology  
Microscopy |  
**Electrophysiology** |
| 4    | Tissue engineering  
Biomaterials  
Artificial organs |  
**Other BME Frontiers** |
| 5    | Biomechanics  
Prosthetics and rehabilitative engineering  
Transport phenomenon |  
**Medical informatics**  
Physiological modeling  
Statistics  
Moral and ethics issues  
Frontiers in BME |
LEARNING ACTIVITIES

- Laboratory
- Poster presentation
- Weekly blog entry
<table>
<thead>
<tr>
<th>Thematic Unit</th>
<th>Laboratory</th>
<th>Learning objective¹</th>
<th>Biology concepts²</th>
<th>Engineering tools used³</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Molecules to Organs</strong></td>
<td>Laboratory safety</td>
<td>1, 2</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aseptic techniques</td>
<td>1, 2</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cell culture &amp; microscopy</td>
<td>1, 2, 4</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DNA and protein extraction, amplification &amp; sequencing</td>
<td>1, 2, 4</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Cell dynamics simulation</td>
<td>1, 2</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Brain dissection &amp; Nissl staining</td>
<td>1, 2, 4</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td><strong>Bio-instrumentation</strong></td>
<td>Basic electronics</td>
<td>1, 2</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Instrumentation amplifiers</td>
<td>1, 2, 4</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electrocardiography</td>
<td>1, 3, 4</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Phonocardiography</td>
<td>1, 3, 4</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Electrophysiology</strong></td>
<td>Neuronal Modeling</td>
<td>1, 3, 4</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Action potentials in worms</td>
<td>1, 3, 4</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Microbial fuel cell</td>
<td>1, 3, 4</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Poster presentation⁴</td>
<td>1, 2, 3, 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PROBLEM BASED LEARNING
DRIP BAG MONITOR / ANXIETY DETECTOR

rotate the screw to fix it on the stand
PROBLEM BASED LEARNING
DRIP BAG MONITOR / ANXIETY DETECTOR
Problems are used as the stimulus and focus for student activity.

PBL pedagogy starts with the problems rather than with exposition of knowledge.

Students acquire knowledge and skills through a staged sequence of problems presented in context.
PBL SPIRAL

Acquisition of knowledge

- Active learning in context
- Integrated, holistic approach
- Lead to deep learning; long-term recall
- Promote development of key skills
- Foster the learning ethic
- Solid foundation for lifelong learning
# GEWS 2050 Living Green Working Green

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What is Green?</td>
</tr>
<tr>
<td>2</td>
<td>Green your appetite: How bad are bananas?</td>
</tr>
<tr>
<td>3</td>
<td>Green your home</td>
</tr>
<tr>
<td>4</td>
<td>Green your wardrobe</td>
</tr>
<tr>
<td>5</td>
<td>Green your waste</td>
</tr>
<tr>
<td>6</td>
<td>Green your energy</td>
</tr>
<tr>
<td>7</td>
<td>Go ÜberGreen!</td>
</tr>
</tbody>
</table>
外至內，常締— 持續的旅程

（這是最後一篇，因為內心充滿感觸，所以篇幅比平常的長）

中大是一個很美的地方，作為一所大學，它的美在於建築與天然環境近乎完美的融合。我記得，人們總笑說，我們在森林裡上課。

逸夫科學大樓是一座很新的建築，有人說這個如地標般色彩繽紛的設計實在難以說服。在我而言它是獨特的。幸而，我們所置身的森林還是一個森林。它雖一樣會用了向山的風向，營造了自然清風的氛圍。

RECENT POSTS
• 外至內，常締— 持續的旅程
• 電動的士來了？
• 讓電子產品省電
• 自家回收小系統
• 食。味

ARCHIVES
April 2013
March 2013
February 2013
January 2013

CATEGORIES
"Serves as an online journal encouraging personal reflection, and as a means of encouraging collaboration through the sharing of links to resources and up-to-date information."

"Offers a unique voice for students, empowering them, and encouraging them to become more critically analytical in their thinking because others can critique, comment, and interpret a blog and therefore a student has to stand by one's opinions."
ENGINEERING EDUCATION

knowledge, skills, professional values
DEEP LEARNING

- **Integrative Learning**: Activities that integrate theories into meaningful applications
- **Reflective Learning**: Activities that assess students’ learning experiences
- **Explorative Learning**: Activities that include more in-depth thought
TELL ME, I WILL FORGET
SHOW ME, I MAY REMEMBER
INVOLVE ME, AND I WILL UNDERSTAND