

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





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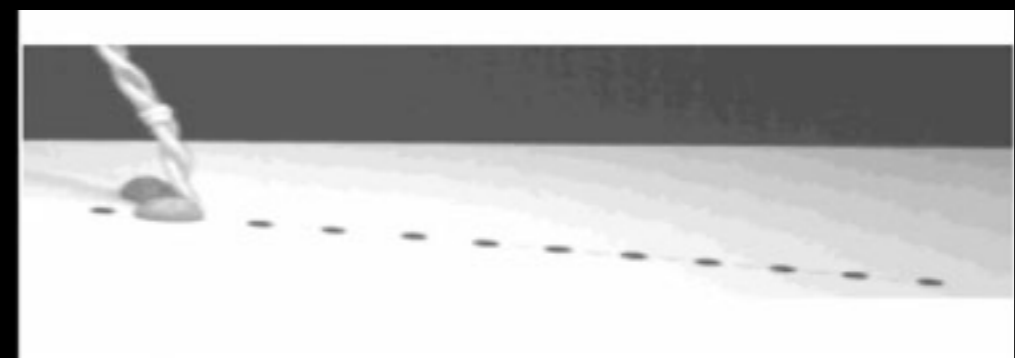
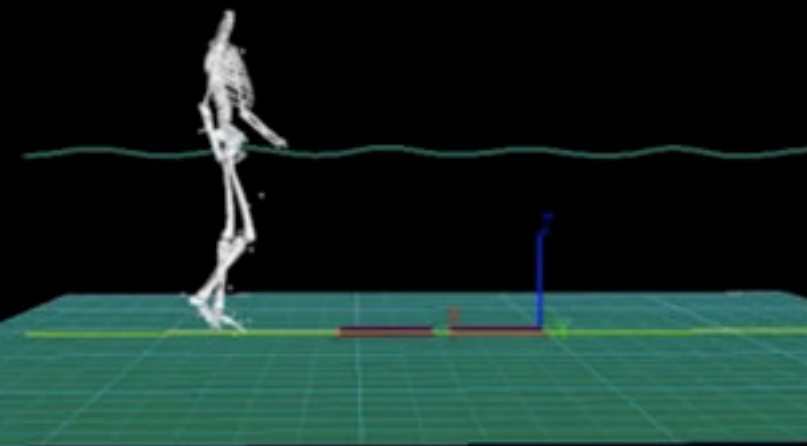
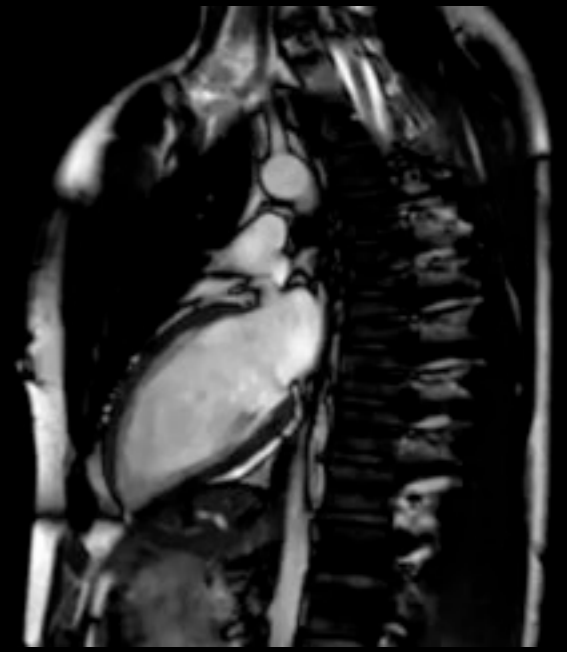
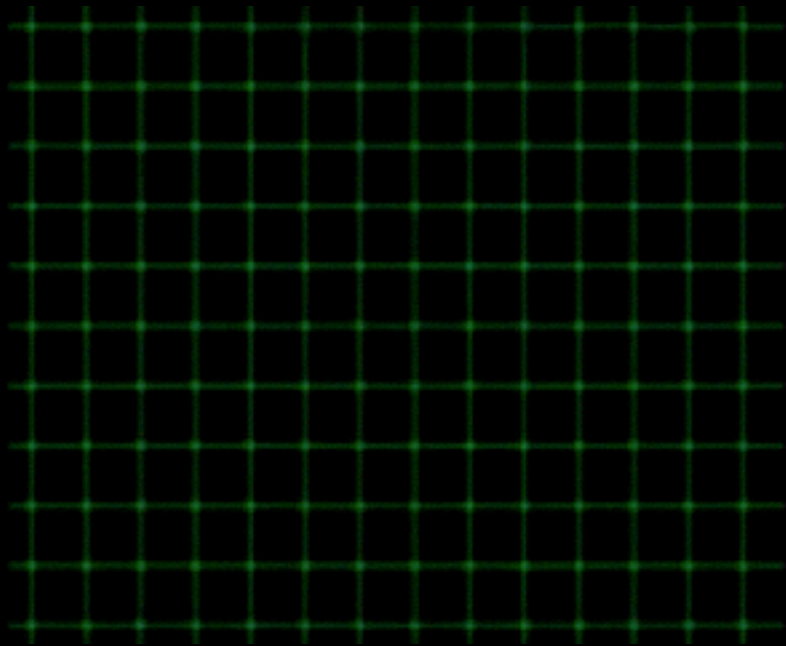
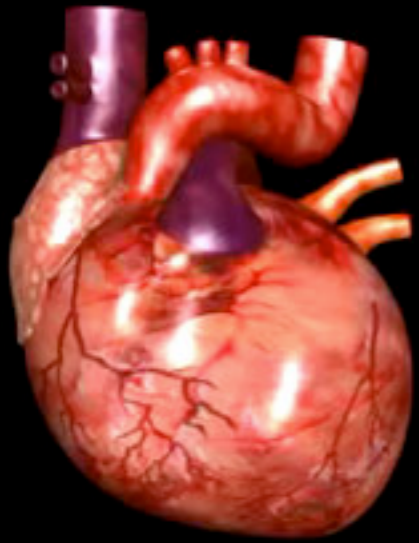
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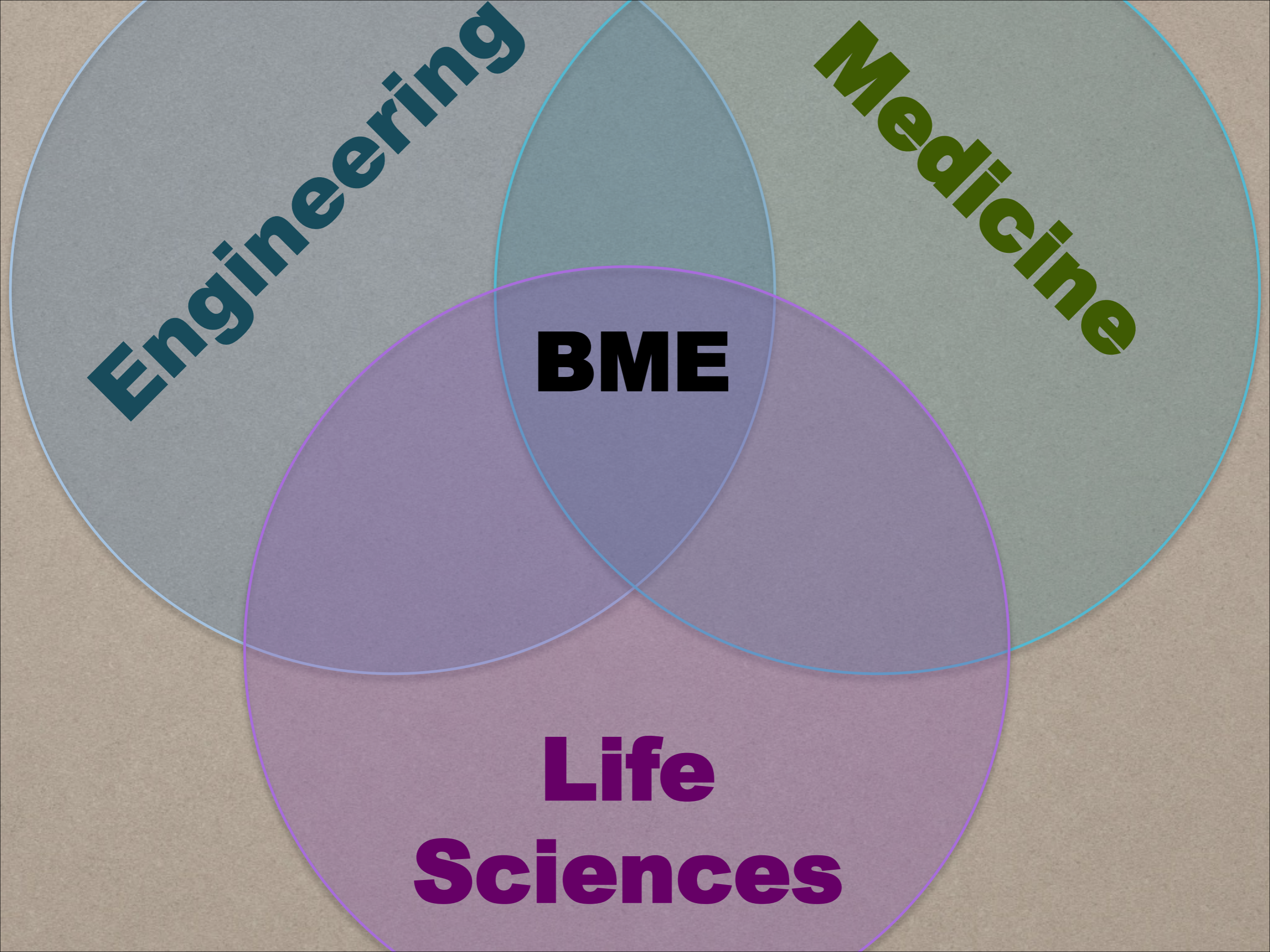


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Engineering

Medicine

BME

**Life
Sciences**

Breadth

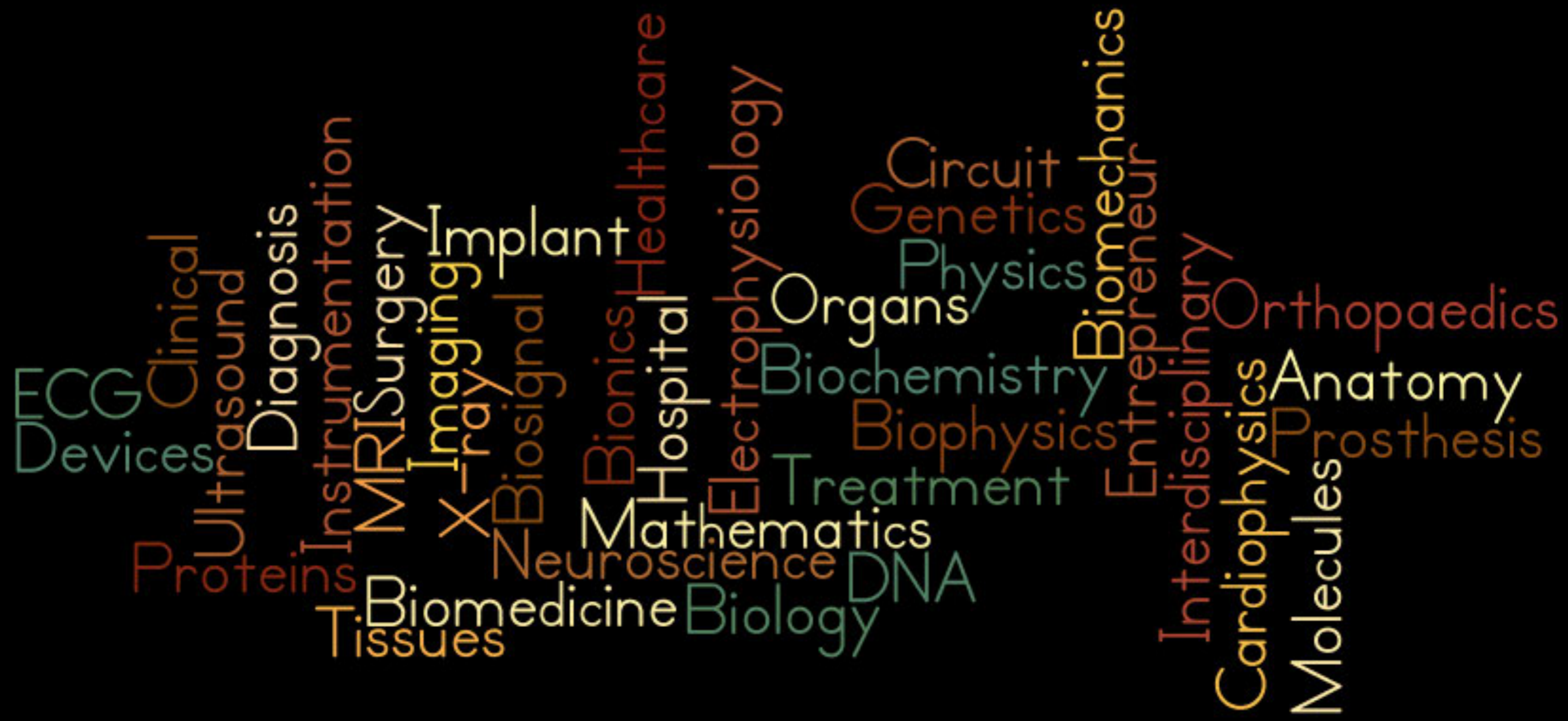


Ability to apply knowledge across situations

Functional / Disciplinary skill

Depth





CHALLENGE: HOW TO DELIVER AN INTRODUCTORY BME COURSE

BMEG 1130/2130/2000/2010

INTRODUCTION TO BIOMEDICAL ENGINEERING

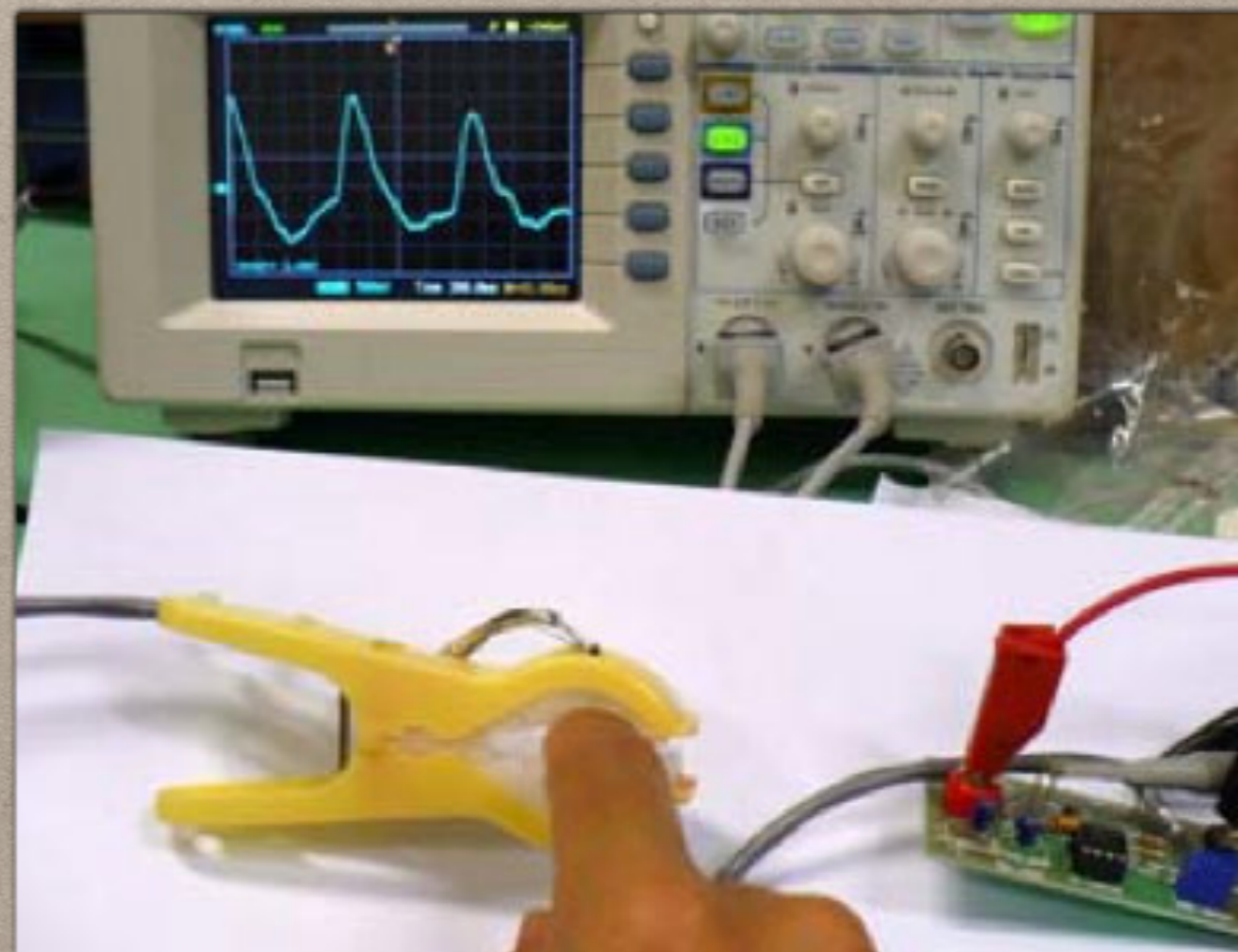
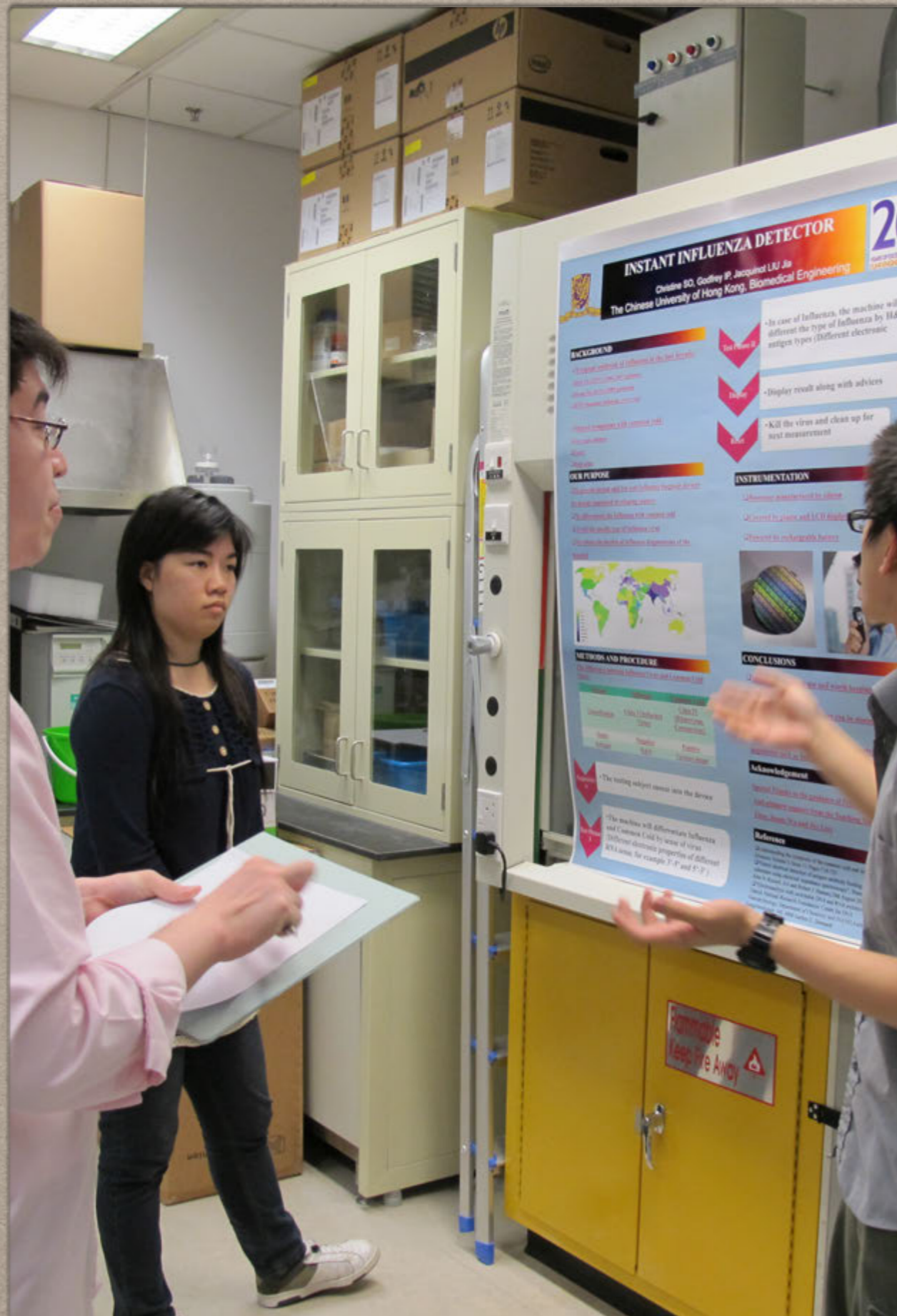
1. Have a general picture of the overall curriculum of the biomedical engineering undergraduate programme, especially on the choice of advanced electives;
2. Build a mathematical, physical, biological and chemical foundation for biomedical engineering;
3. Undertake laboratory using basic techniques in 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.

Week	Lecture content	Thematic Unit
1	Introduction to BME Physiology and anatomy Central dogma of molecular biology	Molecules to Organs
2	Molecular engineering Bioinformatics	
3	Cell engineering Computational cell biology Microscopy	
4	Tissue engineering Biomaterials Artificial organs	
5	Biomechanics Prosthetics and rehabilitative engineering Transport phenomenon	Bio-instrumentation
6	Recap on basic electronics Medical instruments and devices	
7	Bioinstrumentation, sensors and transducers	
8	Bioelectric phenomenon	Electrophysiology
9	Neuroengineering	
10	Electrophysiology	
11	Physiological signal processing	Other BME Frontiers
12	Biomedical imaging and optics	
13	Medical informatics Physiological modeling	
14	Statistics Moral and ethics issues Frontiers in BME	

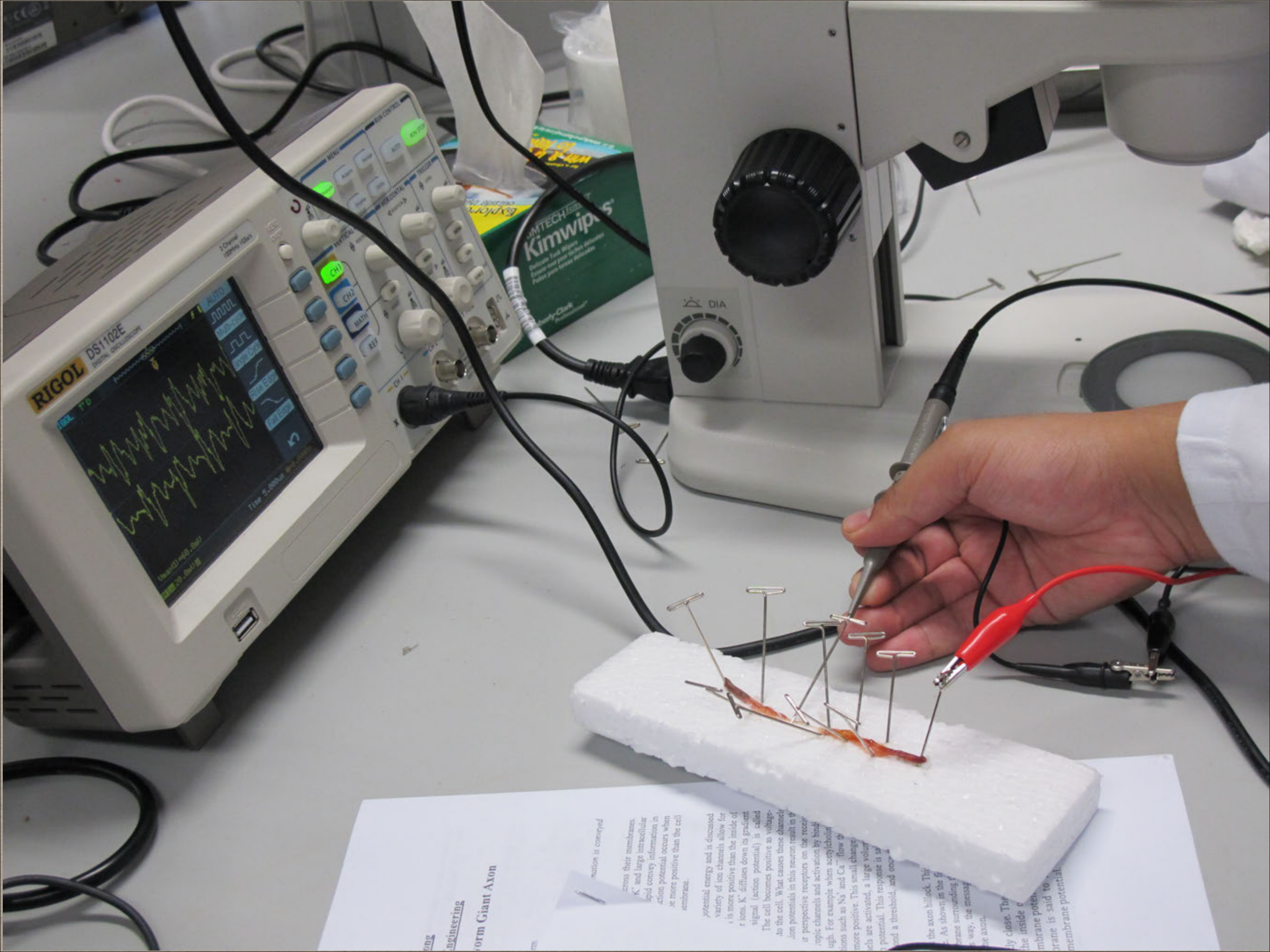
LEARNING ACTIVITIES



- * Laboratory
- * Poster presentation
- * Weekly blog entry



Thematic Unit	Laboratory	Learning objective ¹	Biology concepts ²	Engineering tools used ³
Molecules to Organs	Laboratory safety	1, 2	✓	
	Aseptic techniques	1, 2	✓	
	Cell culture & microscopy	1, 2, 4	✓	
	DNA and protein extraction, amplification & sequencing	1, 2, 4	✓	✓
	Cell dynamics simulation	1, 2	✓	✓
	Brain dissection & Nissl staining	1, 2, 4	✓	
Bio-instrumentation	Basic electronics	1, 2		✓
	Instrumentation amplifiers	1, 2, 4		✓
	Electrocardiography	1, 3, 4	✓	✓
	Phonocardiography	1, 3, 4	✓	✓
Electrophysiology	Neuronal Modeling	1, 3, 4	✓	✓
	Action potentials in worms	1, 3, 4	✓	✓
	Microbial fuel cell	1, 3, 4	✓	✓
	Poster presentation ⁴	1, 2, 3, 4		



RIGOL DS1102E

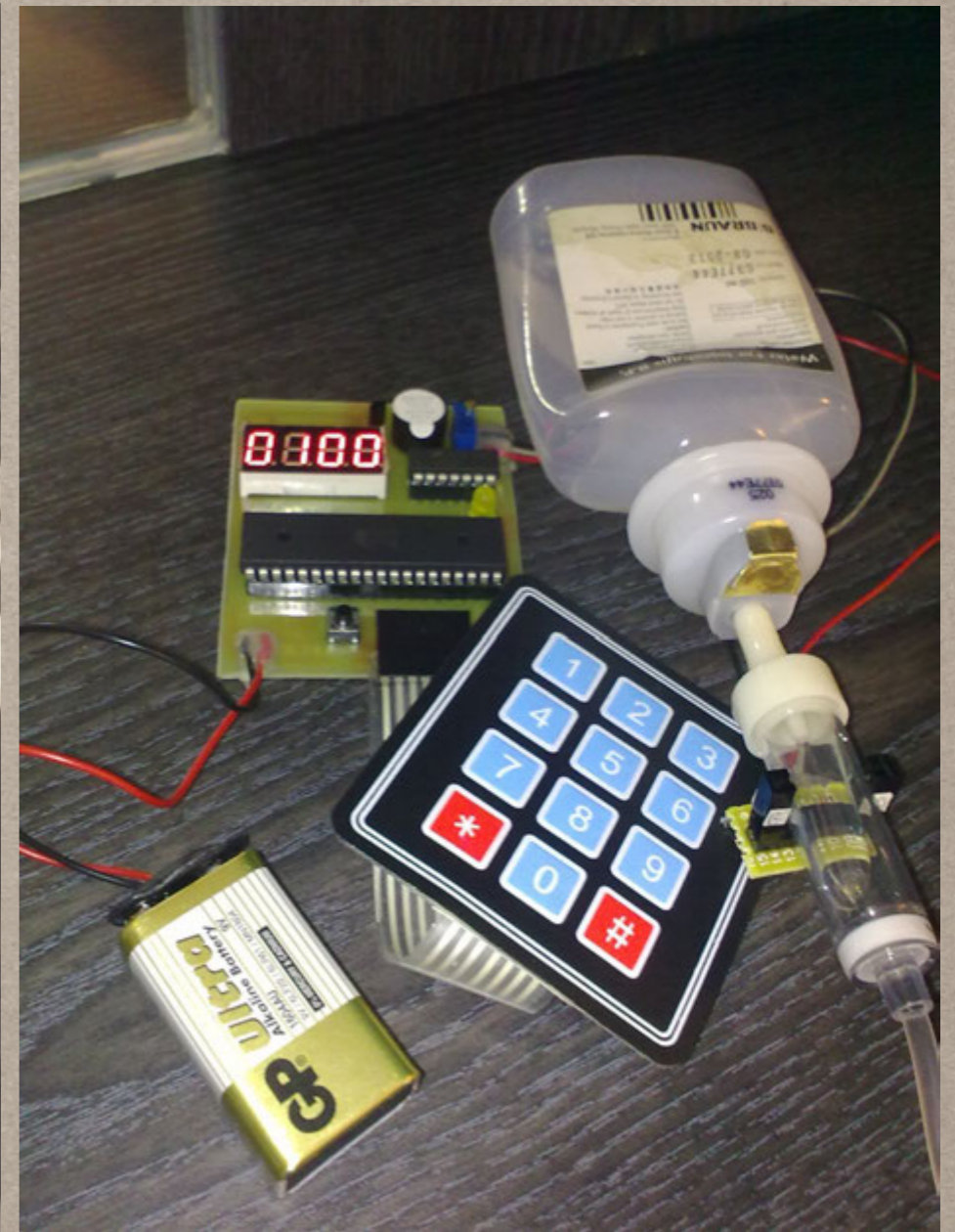


Engineering
Squid Giant Axon

...ation is conveyed
...cross their membranes.
...K⁺ and large intracellular
...lipid convey information in
...action potential occurs when
...e more positive than the cell
...membrane.

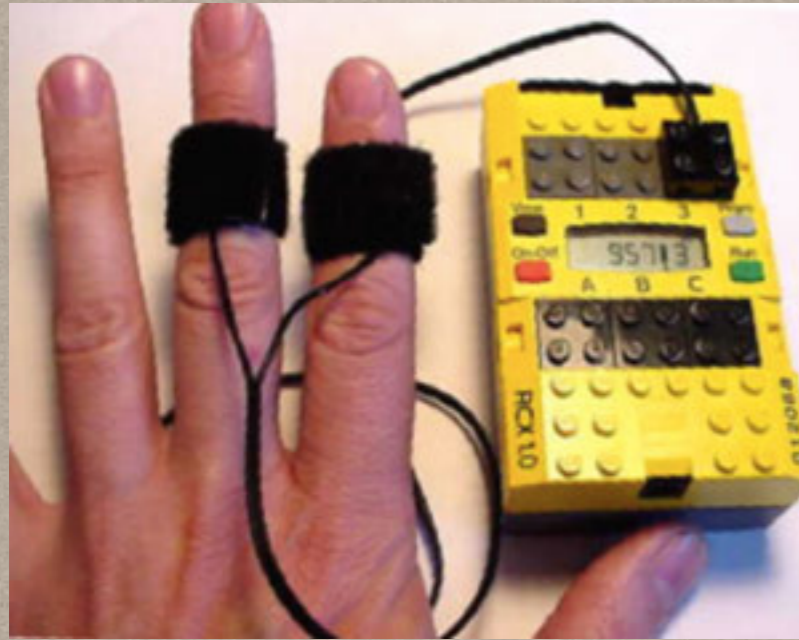
potential energy and is discussed
variety of ion channels allow for
...is more positive than the inside of
...r ions. K⁺ diffuses down its gradient
...signal (action potential) is called
The cell becomes positive as voltage-
...to the cell. What causes these channels
...ion potentials in this neuron result in the
...r perspective receptors, on the recep
...opic channels and activation by bindi
...ugh. For example when acetylcholin
...ions such as Na⁺ and Ca²⁺ flow th
...more positive. This small change
...els are activated, a large volume
...potential. This response is sa
...and a threshold, and once

the axon hillock. The
...As shown in the fi
...brane surrounding
...s way, the messa
...the axon.
...ly close. The
...the inside o
...brane poten
...brane is said to
...membrane potential.



PROBLEM BASED LEARNING

DRIP BAG MONITOR / ANXIETY DETECTOR

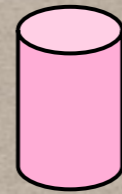
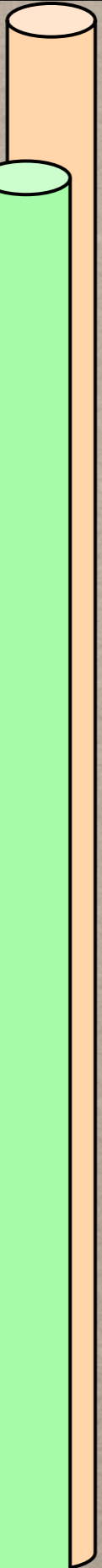
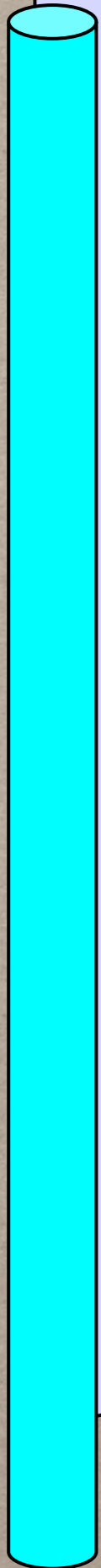
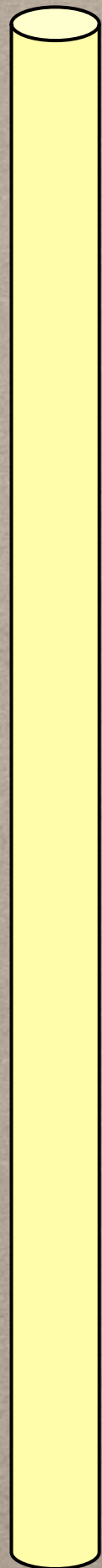


PROBLEM BASED LEARNING

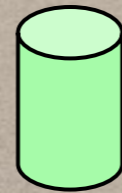
DRIP BAG MONITOR / ANXIETY DETECTOR



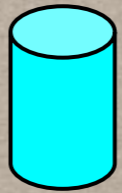
- * Problems are used as the stimulus and focus for student activity
- * PBL pedagogy starts with the problems rather than with exposition of knowledge
- * Students acquire knowledge and skills through a staged sequence of problems presented in context



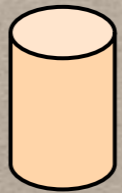
Electronics



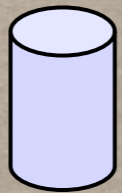
Human physiology



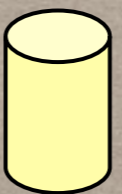
Programming



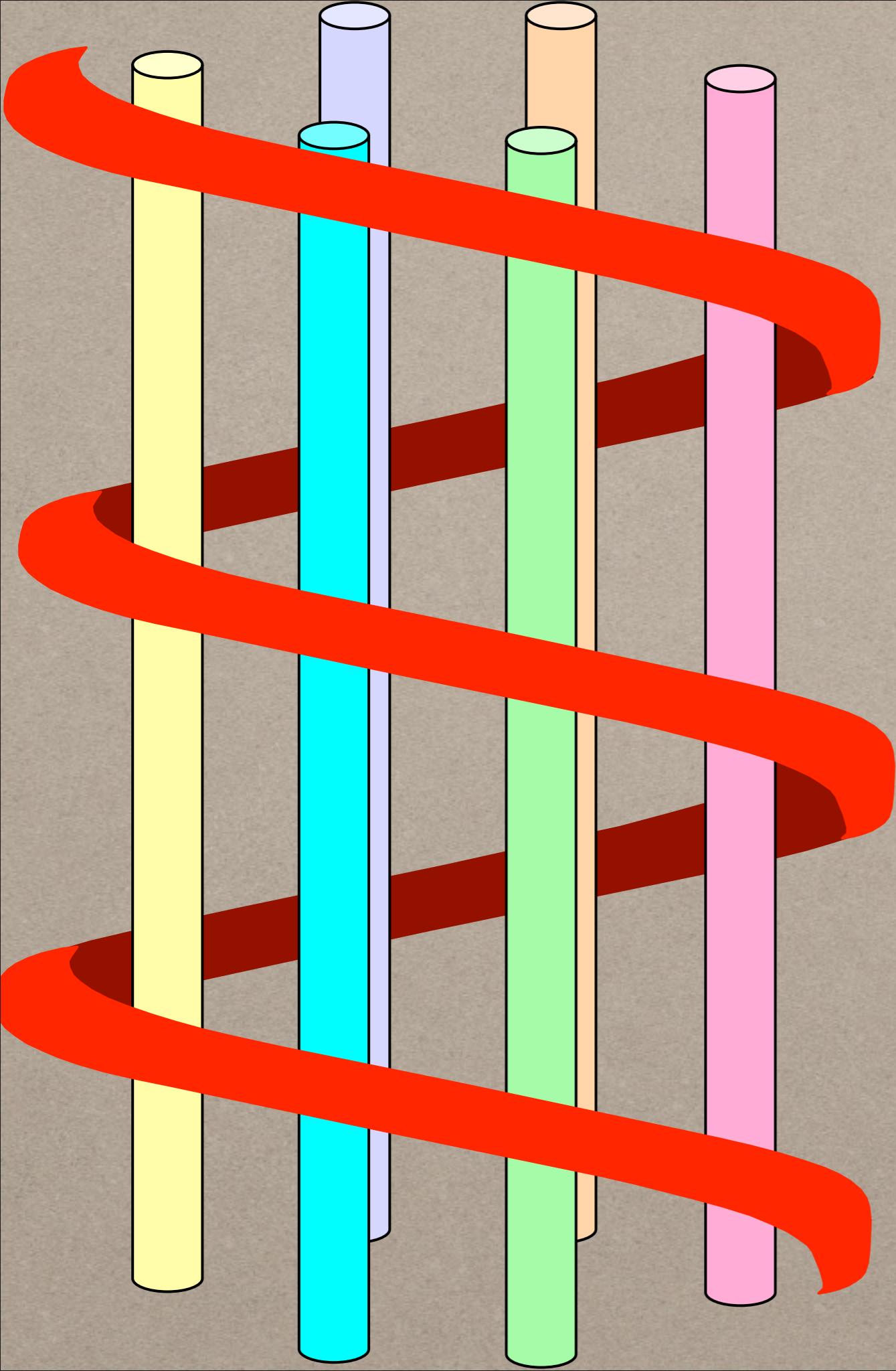
Signal processing



Biopotential acquisition



Prototyping



PBL SPIRAL

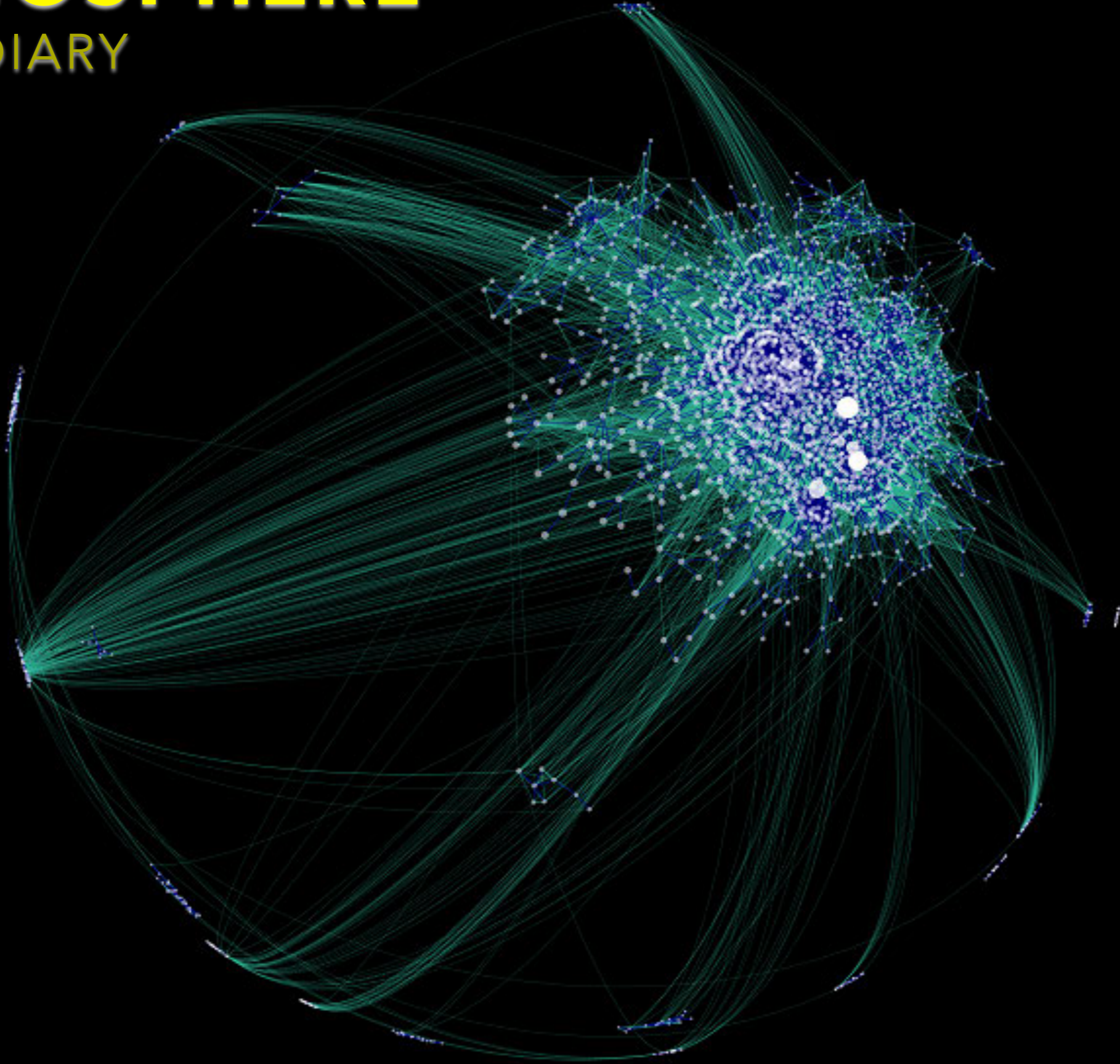


Acquisition of
knowledge

- 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

BLOGOSPHERE

CLASS DIARY



BLOGOSPHERE

GEWS 2050 LIVING GREEN WORKING GREEN

Week	Lecture
1	What is Green?
2	Green your appetite: How bad are bananas?
3	Green your home
4	Green your wardrobe
5	Green your waste
6	Green your energy
7	Go ÜberGreen!



April 6, 2013
Leave a comment

外至內，常綠 — 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，她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。

逸夫科學大樓是一種較新的建築，有人說這個如地標般色彩繽紛的設計會遇到大力反對。在我而言它是搶眼一點，幸而，我們珍而重之的森林還像是個森林，它選擇在善用向山的風向，營造了自然通風的效果。

 SEARCH

RECENT POSTS

- 外至內，常綠 — 持續的旅程
- 電動的土來了？
- 讓電子產品省電
- 自家回收小系統
- 耶，戒煙

ARCHIVES

- April 2013
- March 2013
- February 2013
- January 2013

CATEGORIES

started greening our home

Posted on 二月 6, 2012

just came across the idea of making use of natural ingredient as cleanser in this week's lecture

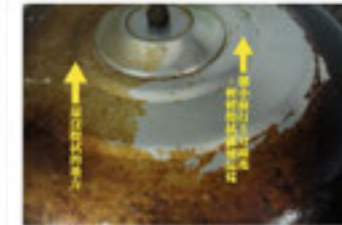
to be frank,i have heard of such idea but i didn't pay much attention on it as i thought those ingredients would be hard to access

after this week's lecture,i went online and search what and how DIY home cleanser can be made

and surprisingly,they are easy to make and more importantly,those ingredients can be easily found too!!

like 1/2 cup of vinegar + a few cups of water or simply some soda powder can be used to clean oily surface in the kitchen

so i told mum and we did a litter experiment and it works surprisingly well!!!!**V*



以下都是家中清潔用的成份表，有新心知悉，別讓提供健康的產品沾上 SLS、SLES，還有國際毒藥的 Cocamide MEA，不知名的防腐劑，漂白粉亞氯，乙炔羧酸鈉的 E12 類……

BLOGOSPHERE

GEWS 2050 LIVING GREEN WORKING GREEN

"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"

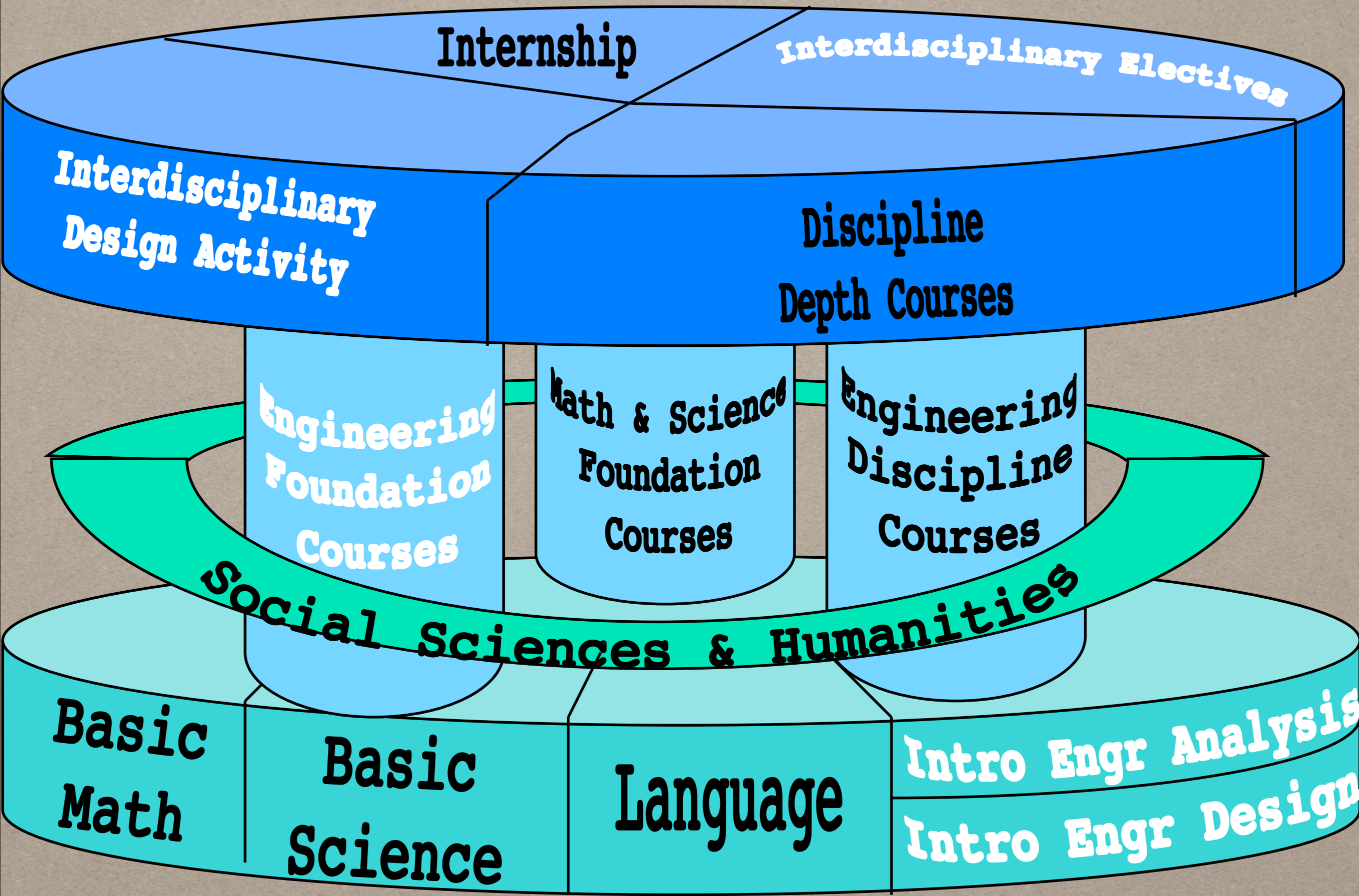
"Offers a unique voice for students, empowering them, and encouraging them to become more critically analytical in their thinking because others can critique, comment, and interpret a blog and therefore a student has to stand by one's opinions"



knowledge

skills

professional values



Internship

Interdisciplinary Electives

Interdisciplinary Design Activity

Discipline Depth Courses

Engineering Foundation Courses

Math & Science Foundation Courses

Engineering Discipline Courses

Social Sciences & Humanities

Basic Math

Basic Science

Language

Intro Engr Analysis

Intro Engr Design

DEEP LEARNING

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graph LR; A[DEEP LEARNING] --> B[Integrative Learning]; A --> C[Reflective Learning]; A --> D[Explorative Learning];
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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