

University of Wisconsin-Madison Biomedical Engineering

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What is Engineering?

- “...the discipline, art and profession of acquiring and applying technical, scientific, and mathematical knowledge to design and implement materials, structures, machines, devices, systems, and processes that safely realize a desired objective or invention.”

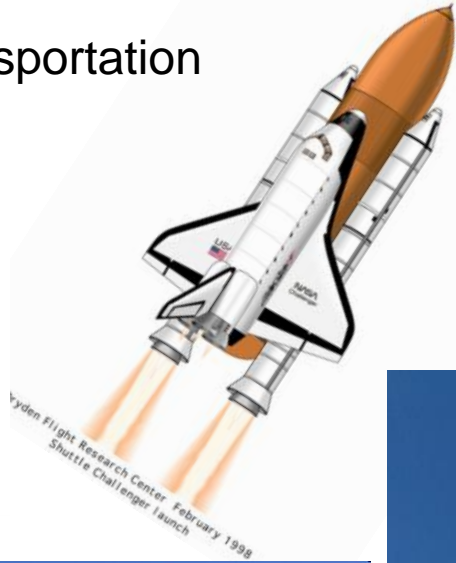
- Wikipedia

What is Engineering?

- In simpler terms...using math, science, and technical skills to
 - Solve problems
 - Design and test solutions

What do Engineers do?

Transportation



Renewable Energy



Building and Structure Design

...and **much, much** more!!!

Types of Engineering

- Biological Systems (Agricultural)
- Biomedical
- Chemical and Biological
- Civil and Environmental
- Computer
- Electrical
- Mechanics and Astronautics
- Engineering Physics
- Geological
- Industrial
- Materials Science
- Mechanical
- Nuclear

Importance of Engineering: Top 10 Engineering Achievements of the 20th Century

1. Electricity
2. Automobile
3. Airplane
4. Water Supply and Distribution
5. Electronics
6. Radio & Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning and Refrigeration

Importance of Engineering

- When engineering goes wrong...
- Tacoma Narrows Bridge
 - Washington, 1940
 - <http://www.youtube.com/watch?v=P0Fi1VcbpAI>

Become an Engineer!

- Typical Core Engineering Courses
 - Math
 - Calculus and Statistics
 - Physics (focus on Electricity/Magnetism)
 - Chemistry
 - Mechanics (Statics and Dynamics)
- Major-specific courses
- Design courses

Become an Engineer!

- Many engineering students in college participate in an internship, co-op or research position
 - Work at an engineering job (sometimes by taking off of school) to gain experience
- Engineers are constant learners, gaining new knowledge and on-the-job experience throughout their careers

What about that “Biomedical” one?

- “...the application of engineering principles and techniques to the medical field.”

- Wikipedia

Areas of Biomedical Engineering

- Bioinstrumentation
- Biomaterials
- Biomechanics
- Medical Imaging
- Tissue Engineering
- Human Factors and Ergonomics
- ...many others!

Typical BME Courses

- Biological Science Classes
 - Biology
 - Physiology
 - Anatomy
- Biomaterials
- Biomechanics
- Bioinstrumentation
- Relevant courses in other engineering disciplines

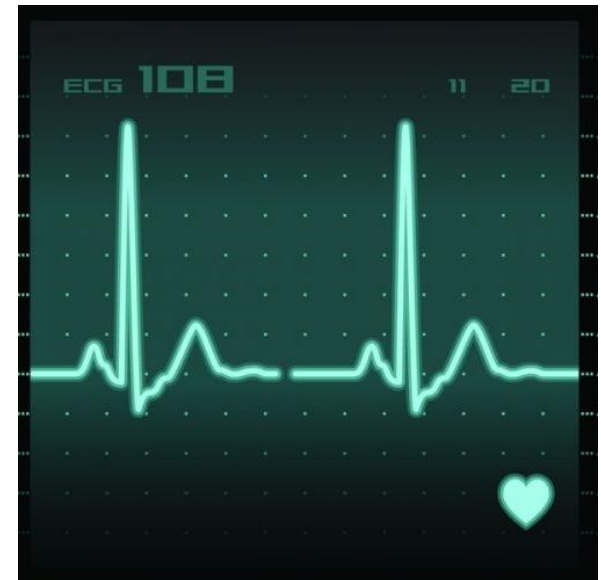
Biomaterials

- “...any material, natural or man-made, that comprises whole or part of a living structure or biomedical device which performs, augments, or replaces a natural function.” - Wikipedia



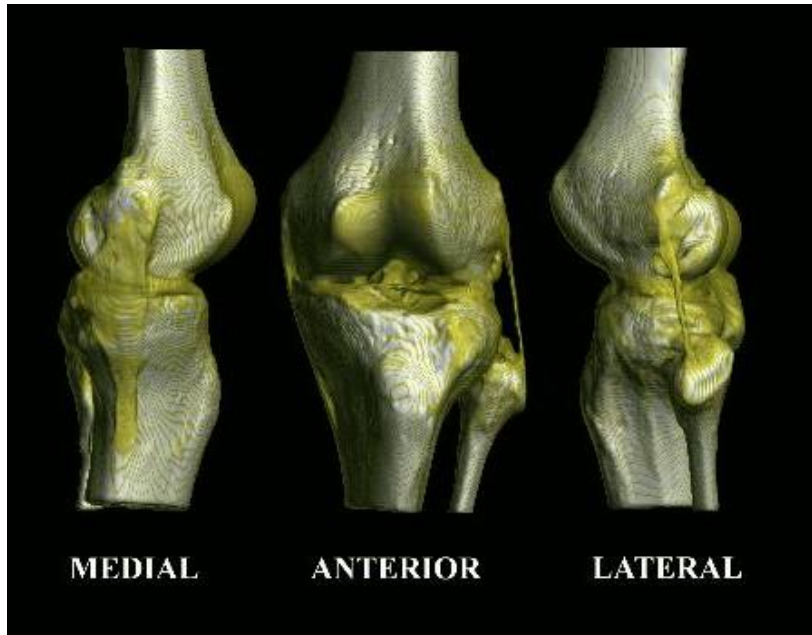
Bioinstrumentation

- ...the design and development of devices that measures or manipulates biological and physiological variables, like heart rate, respiratory rate, and blood glucose levels



Biomechanics

- The study of living organisms subjected to forces and displacements and their interaction with their environment
 - Joint Mechanics
 - Fluid Mechanics of blood



Medical Imaging

- “...the technique and process of creating images of the human body for clinical purposes and medical science.”

- Wikipedia



MRI



X-Ray

Biomedical Engineering Potential

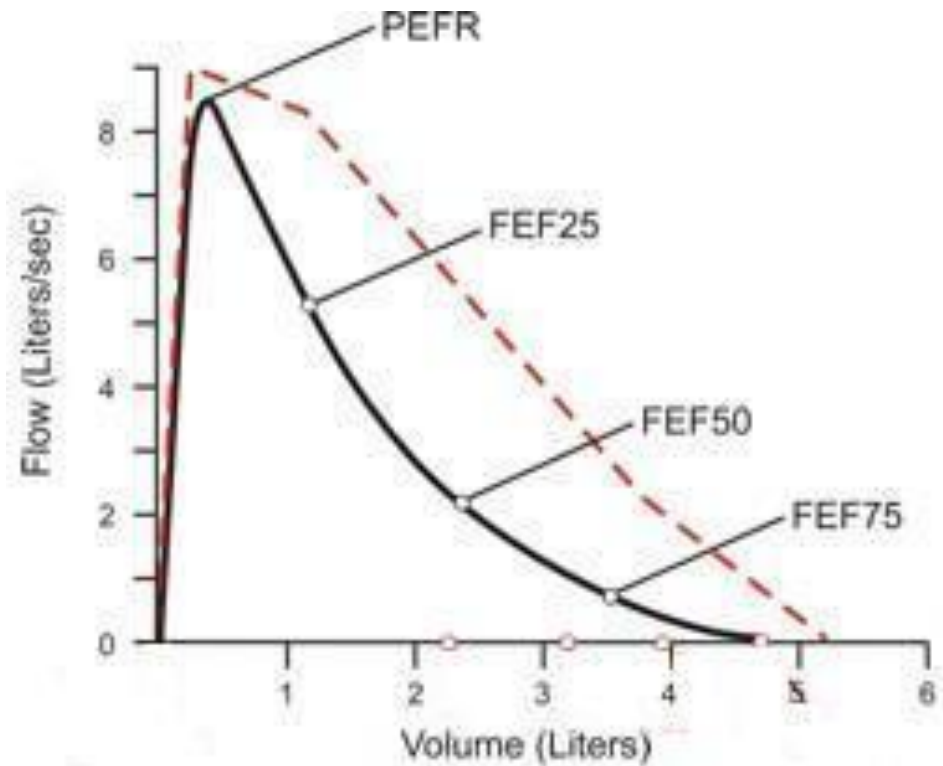
- Brainport

- <http://www.youtube.com/watch?v=xNkw28fz9u0&feature=related>

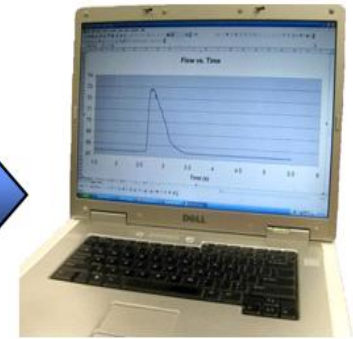
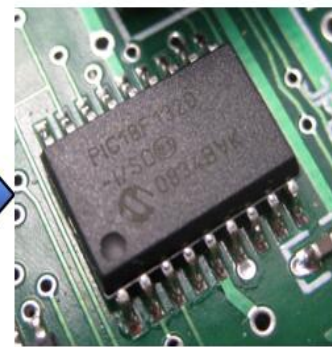
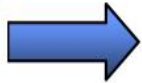


What We're Designing

- Low-cost, open source spirometer
 - Measurement of expiratory air flow and volume
 - Diagnose and track diseases like asthma and emphysema
 - Use in developing countries limited due to cost



What We're Designing



User

- Expires through spirometer

Spirometer

- Records Pressure Drop

Microcontroller

- Converts signal to flow and volume

Computer

- Final calculations and data display

Design Process: Mouthpiece Material Selection

- Make choices - often not one “right” choice but rather a combination of considerations
- Which mouthpiece should be used?
 - Permanent, reusable mouthpiece
 - Disposable cardboard
- Factors to consider
 - Cost
 - Ease of use
 - Transmission of diseases
 - Ergonomics



Questions?

