Engineering as a Career

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Biomedical Engineering
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What is engineering all about?

- Solving problems
- Creative thinking
- Designing new things
- Making the world a better place
- Teamwork

Why should you be an engineer?

- Job security
  - Only 2% unemployment rate
- Good salary
  - Average starting at about $50,000/yr
- Engaging work
  - Challenging, but rewarding
  - Improve our world

Types of Engineering

- **Biomedical Engineering**
- Chemical Engineering
- Civil/Environmental Engineering
- Electrical/Computer Engineering
- Engineering Physics
- Geological Engineering
- Industrial/Systems Engineering
- Materials Science and Engineering
- Mechanical Engineering

Chemical Engineering

- Focus on using chemistry to develop products and processes
- Applications:
  - Alternative fuel-cells
  - Ultra-strong materials
  - Pharmaceuticals
  - Food science

Civil & Environmental Engineering

- Design, construct, and maintain both natural and manmade structures and systems

- Applications:
  - Construction
  - Infrastructure
    - Highways, canals, pipelines, etc.

Electrical & Computer Engineering

- Apply knowledge of electricity and circuitry to create electronics and computers
- Applications:
  - Power and communications
  - Robotics
  - Personal electronics

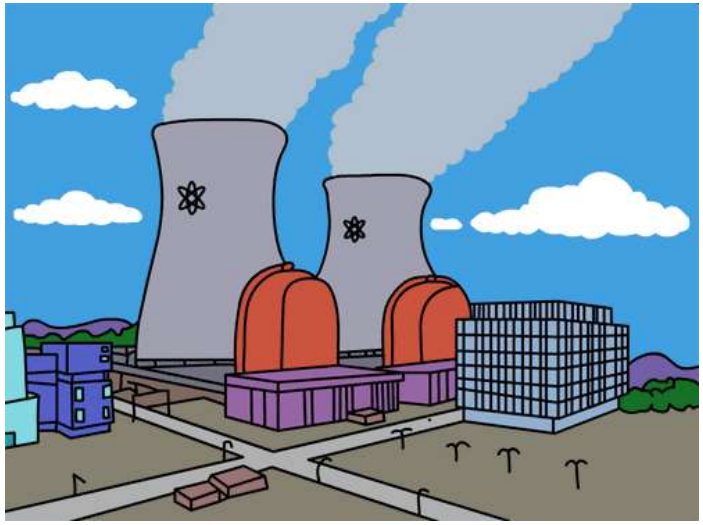
Mechanical Engineering

- Design, production, and manufacturing of mechanical systems and tools

- Applications:
  - Automotive
  - Heating/cooling
  - Physical design

Other Engineering Disciplines

- Engineering Physics
  - Mechanics, physics, nuclear engineering
  - Aeronautics
- Geological Engineering
  - Use the earth and its natural resources
  - Mining, oil and gas, etc.

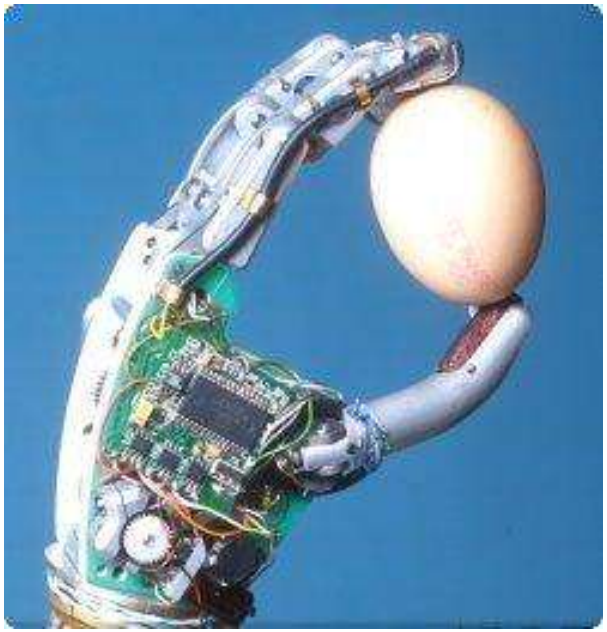


Other Engineering Disciplines

- Industrial/Systems Engineering
  - Aim to increase efficiency in manufacturing and other processes
- Materials Science and Engineering
  - Analyze structure and properties of different materials

Biomedical Engineering

- What is it?
  - It combines many types of engineering with medical and biological applications



Could BME be right for you?

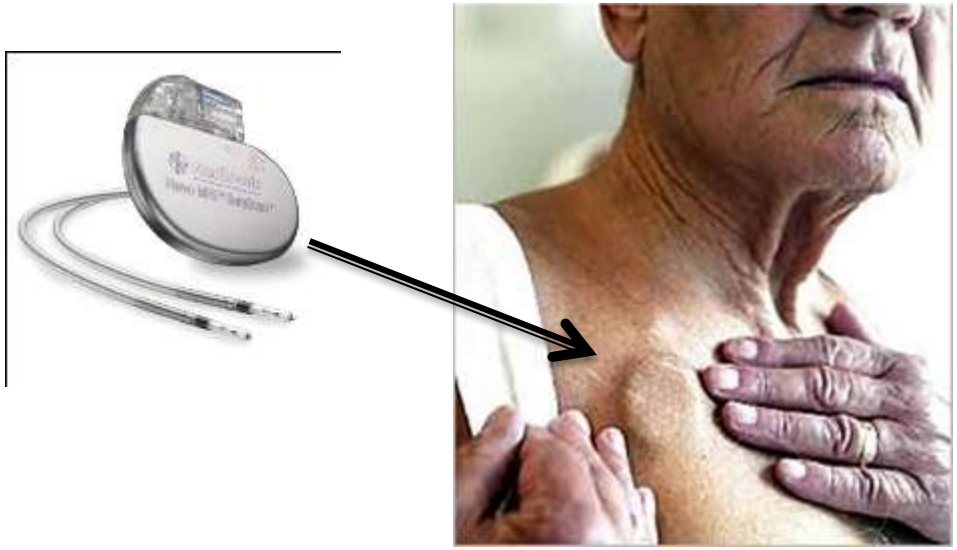
- Interests
  - Science, both biology and physical sciences
  - Math
  - Problem solving
  - Helping others
- Enjoy being challenged

Specializations Within BME

- Bioinstrumentation
- Tissue Engineering/Biomaterials
- Biomechanics
- Healthcare Systems and Medical Informatics
- Medical Imaging

Bioinstrumentation

- Electronics applied to solve medical or biological problems



Applications of Bioinstrumentation

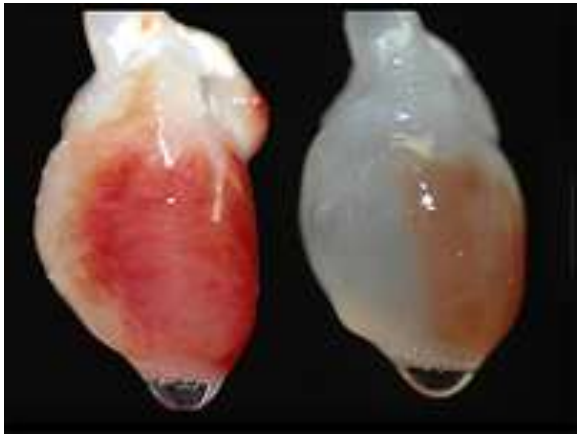
- Myoelectric prosthetics
- Brain-computer interface
- Exoskeletons

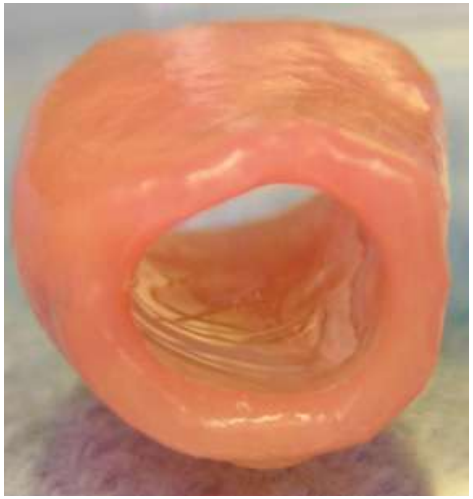
Tissue Engineering/Biomaterials

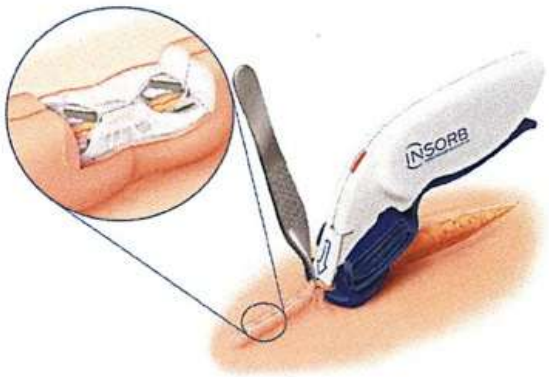
- Biomaterials
  - Study of biological interactions with materials
- Tissue Engineering
  - Regenerative medicine
    - Regenerate damaged or lost tissue using various engineering methods

Applications of Tissue Engineering/Biomaterials

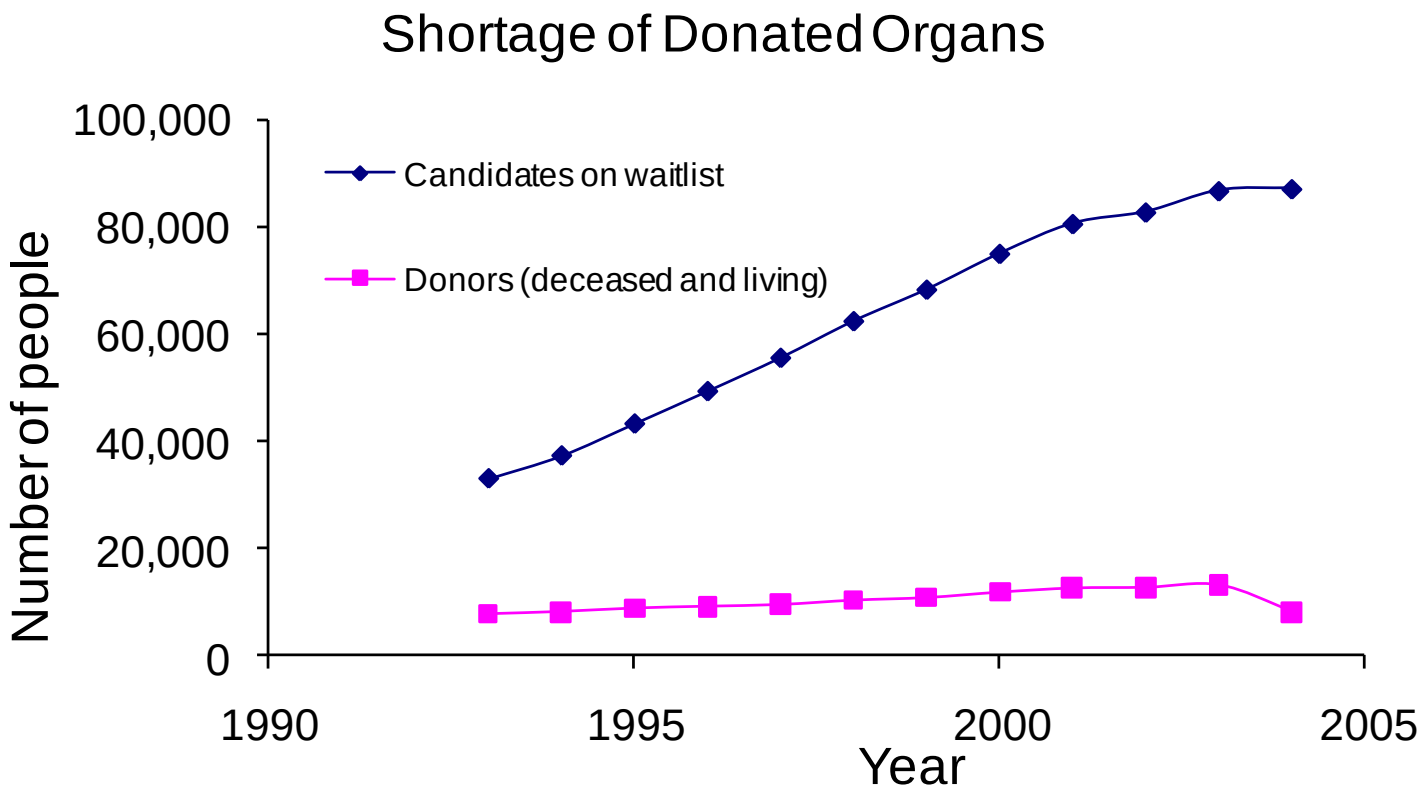
- Implants, drug delivery, bandages, sutures
- Artificial tissue
  - Organs, muscles, cartilage, etc.







Need for Tissue Engineering



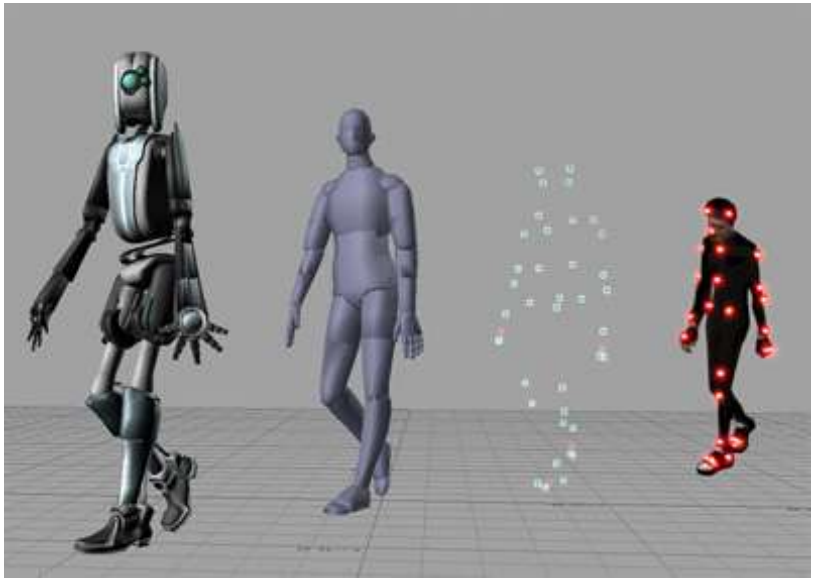
- Tissue engineering could solve this problem!

Biomechanics

- Structure and function of the human body
- Sub disciplines of biomechanics
  - Orthopedics
  - Motion analysis
  - Ergonomics

Applications of Biomechanics

- Prosthetics
- Fluid flow throughout the body
- Study of motion



Healthcare Systems and Medical Informatics

- Healthcare management and electronic information systems
- Improves security, efficiency, and response/treatment time

Medical Imaging

- Technique that is used to create human body images
- Useful for diagnosis and functional understanding
  - MRI, PET, CT, X-ray, Ultrasound, etc.

Job Opportunities

- Industry
  - Medical devices
  - Biomaterial development
  - Healthcare systems
  - General engineering
- Government
  - FDA (Food and Drug Administration)
  - NIH (National Institutes of Health)

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Further Education

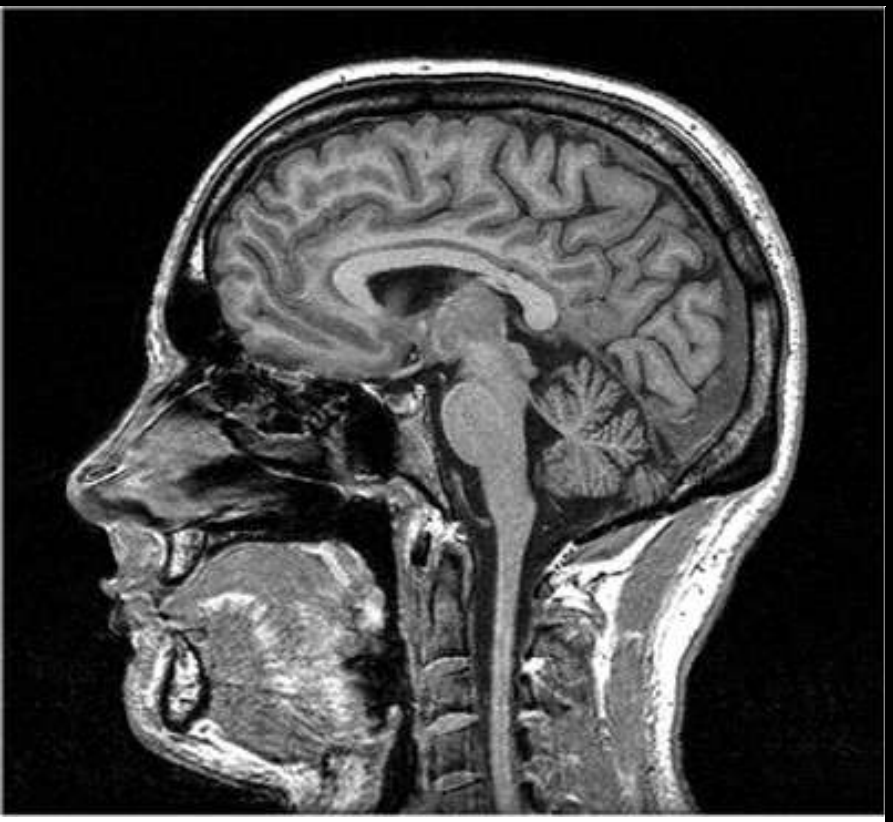
- Graduate school
  - Masters degree
  - PhD degree
  - Specialized job opportunities
  - Become a professor
- Medical school
  - Become a doctor
- Research

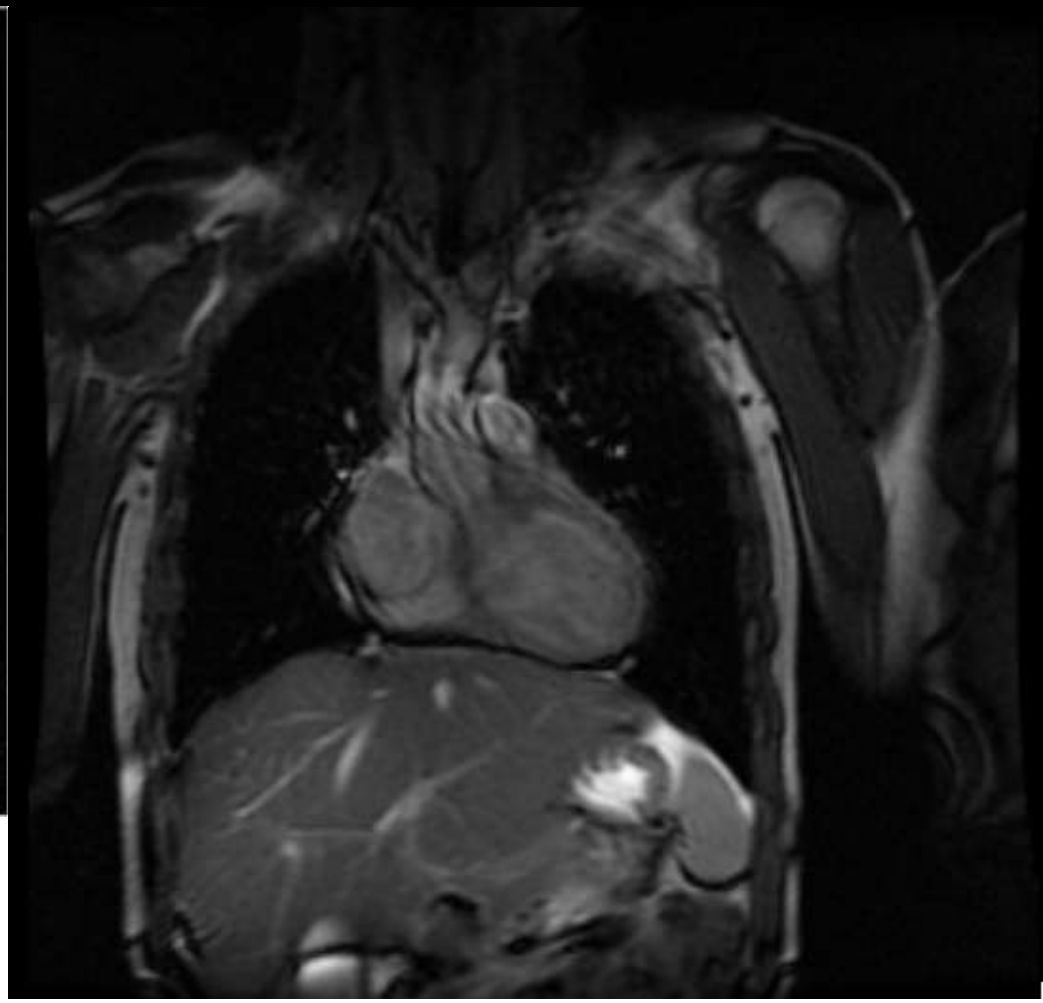
Biomedical Engineering as a Career

- The New York Times called biomedical engineering the #1 new job of the next decade
- Rated as best career in 2011 by U.S. News & World Report
- Facts from Bureau of Labor Statistics
  - 2010 median salary of $81,540
  - Projected increase in jobs of 62% from 2010-2020
- Other Benefits
  - Improve peoples' lives
  - Wide range of focuses

Our Design Project

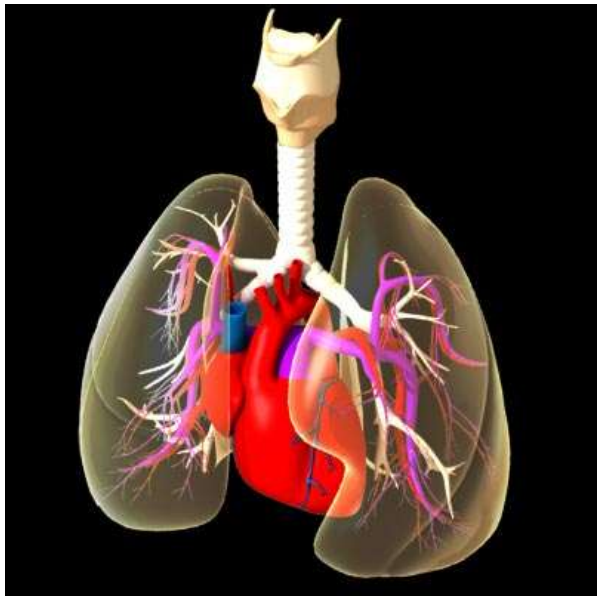
- MRI-compatible exercise device
- Magnetic resonance imaging (MRI)
  - Powerful magnetic field interacts with water molecules in your body
  - Body tissues with different densities show up as light and dark spots
  - All body tissues can be seen, not just bones in x-rays





Our Design Project

- MRI-compatible exercise device
- Patient exercises while MRI scans are taken
- Assess effects of exercise on blood flow from the heart to the lungs

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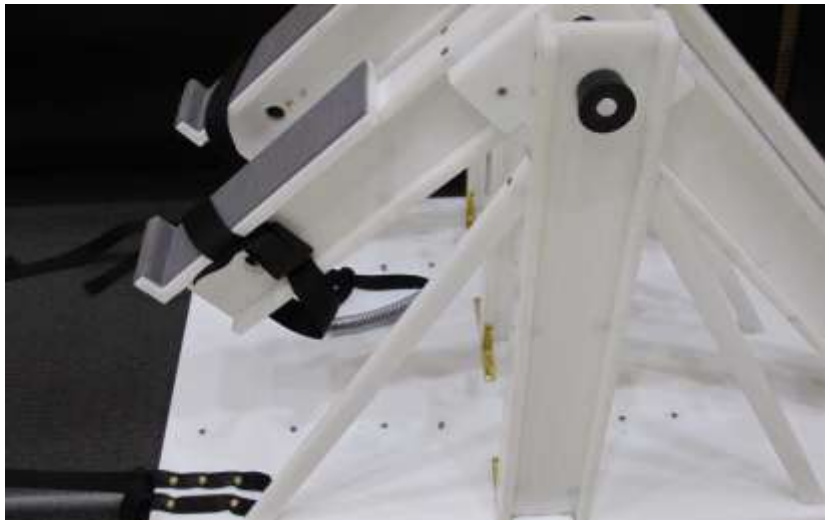
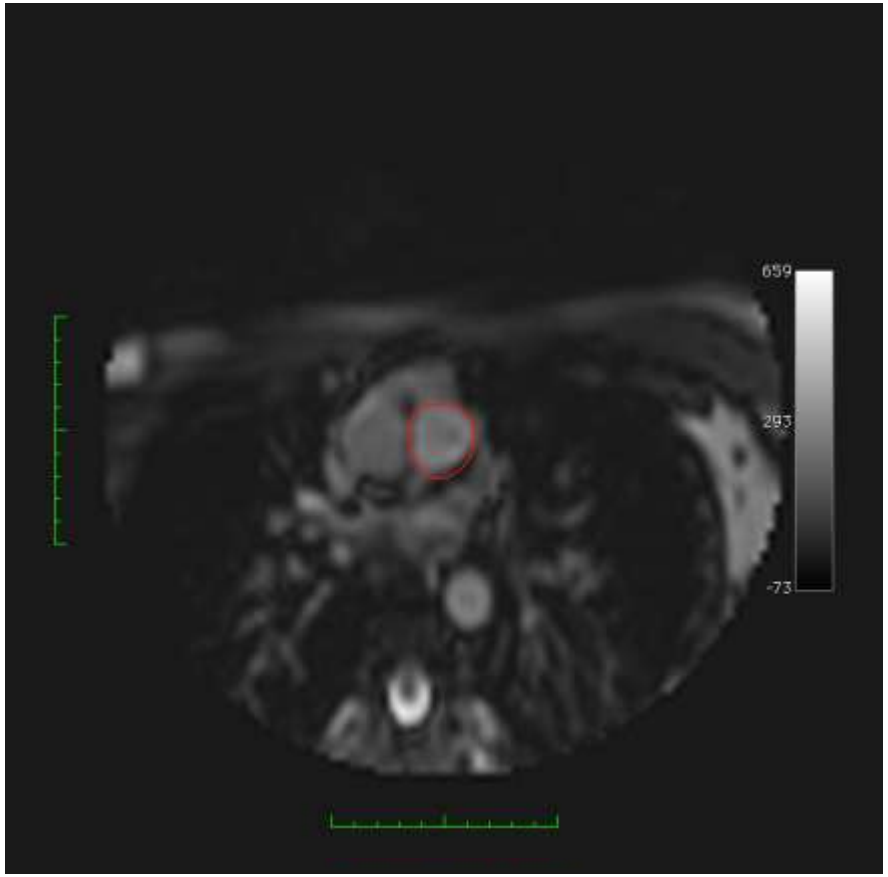
Our Design Project

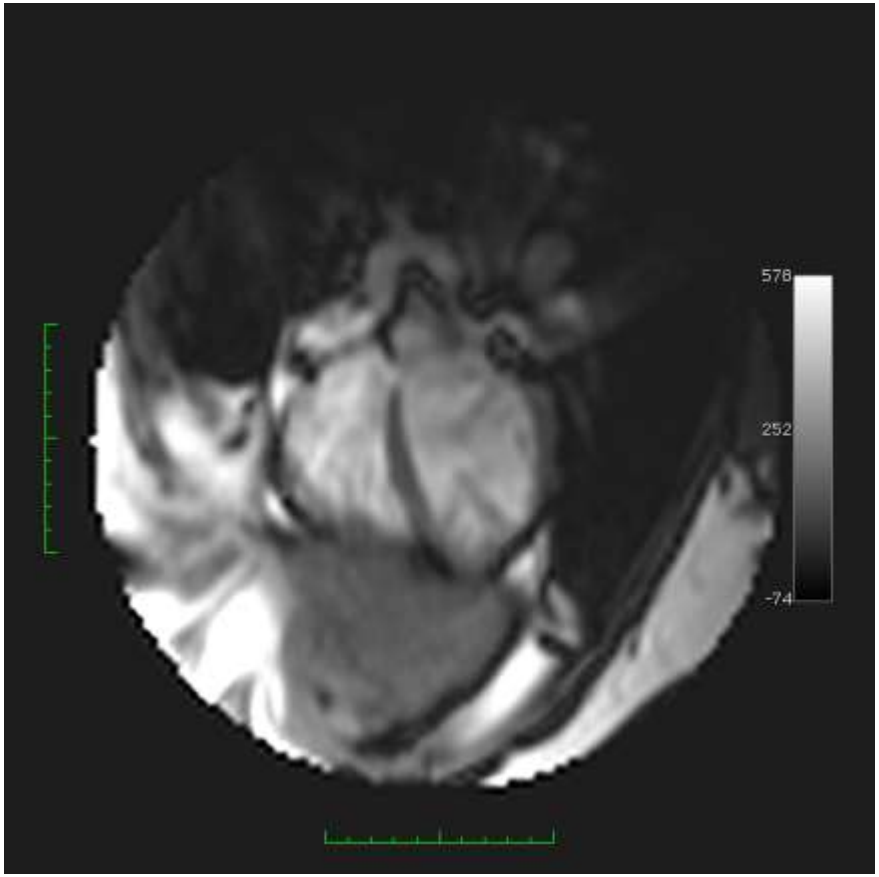
- MRI-compatible exercise device
- Device made of non-magnetic materials
  - Plastic, brass, aluminum, and ceramics
- User pushes on lever arm to lift weight
- Stepping motion



The Device in Action

MRI Images from Testing





Conclusion

- Engineering is cool, fun, and rewarding
- You should do it! You have what it takes!
- Especially biomedical engineering

- Any questions?