January 18, 2017
Lecture 1: Welcome!
Intro to biomechanics
Goals for today

- Get to know each other
- Course admin and ground rules
- Biomechanics
- Whole body biomechanics overview
- Anatomical terminology
Introductions

- Class: Whole body musculoskeletal biomechanics
- Instructors: Prof. Mariana Kersh
- TA: Lydia Bakalova

Course webpage: [https://courses.engr.illinois.edu/me481/index.html](https://courses.engr.illinois.edu/me481/index.html) and compass2g
A little about me...

BA English

BS, MS Mech Eng

PhD, InterD Mat Sci

PhD with Zimmer, GmbH

U Melbourne

http://www.vectorworldmap.com/
Other side of the note card:

- Biomechanics is …

- Why you are taking this class?
Course admin

- Expectations
  - Mutual respect
  - Compass2g/lecture slides
  - Participation
    - Come to class
    - Ask questions!!
Expectations

- Respect at all times
- Compass2g/lecture slides
- Participation
  - Come to class
  - Ask questions!!
- Timing
  - I promise to finish at 1:50 (mid-slide if need be)
  - You promise to not start to pack up early (even if I’m on the last slide)
- Email/communication policy (put ME481 in subject line)
- Have some fun!
Grading

- Homework: TBD%
- Labs: TBD%
- Semester project: 25%
- Topic tests
  - Test 1: 10%
  - Test 2: 10%
  - Test 3: 10%
- Final Exam: 15%
Project

- Hands on lab project - group work
- Peer assessment will be part of the grade
- Writing fluency will also be an important part!

THE NEUROBIOLOGY OF WRITING

HOW IT'S SUPPOSED TO WORK:

- Process Language: Temporal Lobes
- Control Hands: Motor cortex
- Transmit Command: Brain stem
- Activate Muscles: Motor neuron
- Type: Flexor digitorum
- Execute Command: Prefrontal cortex
- Success! Words

HOW IT USUALLY WORKS:

- Insecurity: Limbic System
- Confusion: Prefrontal cortex
- No Motivation: Anterior cingulate cortex
- Fear: Amygdala
- Hesitation: Inferior frontal gyrus
- Panic: Sympathetic System

WWW.PHDCOMICS.COM
Project

- Hands on lab project - group work
  - Peer assessment will be part of the grade
  - Writing fluency will also be an important part!

How it will work

- Ground reaction force
  - Your peers will be the subjects

- Data collection prior to Spring Break
  - Formal written report
  - Presentations at the end of the semester
What is biomechanics?
What is biomechanics?
Biomechanics

Giovanni Borelli
1608-1679

‘On the Movement of Animals’ ca. 1680
Biomechanics at different scales
Research Aims

Clinical needs

Basic science and technology advancement

Slide courtesy Prof. Marcus Pandy
Joint tissue failure: a growing problem

Hip fractures

- 8,000,000/year by 2050¹
- 25% mortality within 1 year²
- 50% permanent disabilities²

Osteoarthritis

- 1-3% of GDP of industrialized nations treating rheumatic disease (mostly OA)³
- US costs⁴
  - 1997: $233.5B
  - 2003: $321.8B

¹ Sernbo et al., 1993  ² Cummings et al., 2002  ³ Leardini et al 2004   ⁴ Yelin et al., 2007
Whole body biomechanics
Engineering approach

Experiments

Numerical simulations

Modeling

Model evaluation

Slide courtesy Prof. Marcus Pandy
Approach to studying whole body biomechanics
A common language...
Movement about M-L axis
Movement about PD axis
Movement about AP axis

Varus my horse?

Musculoskeletal system

Human movement

Gait lab

Background readings will be linked on course webpage