BMEG 230 Biomechanics I

Lecture 1 | Week 1

Thursday, Sept 5th 2024

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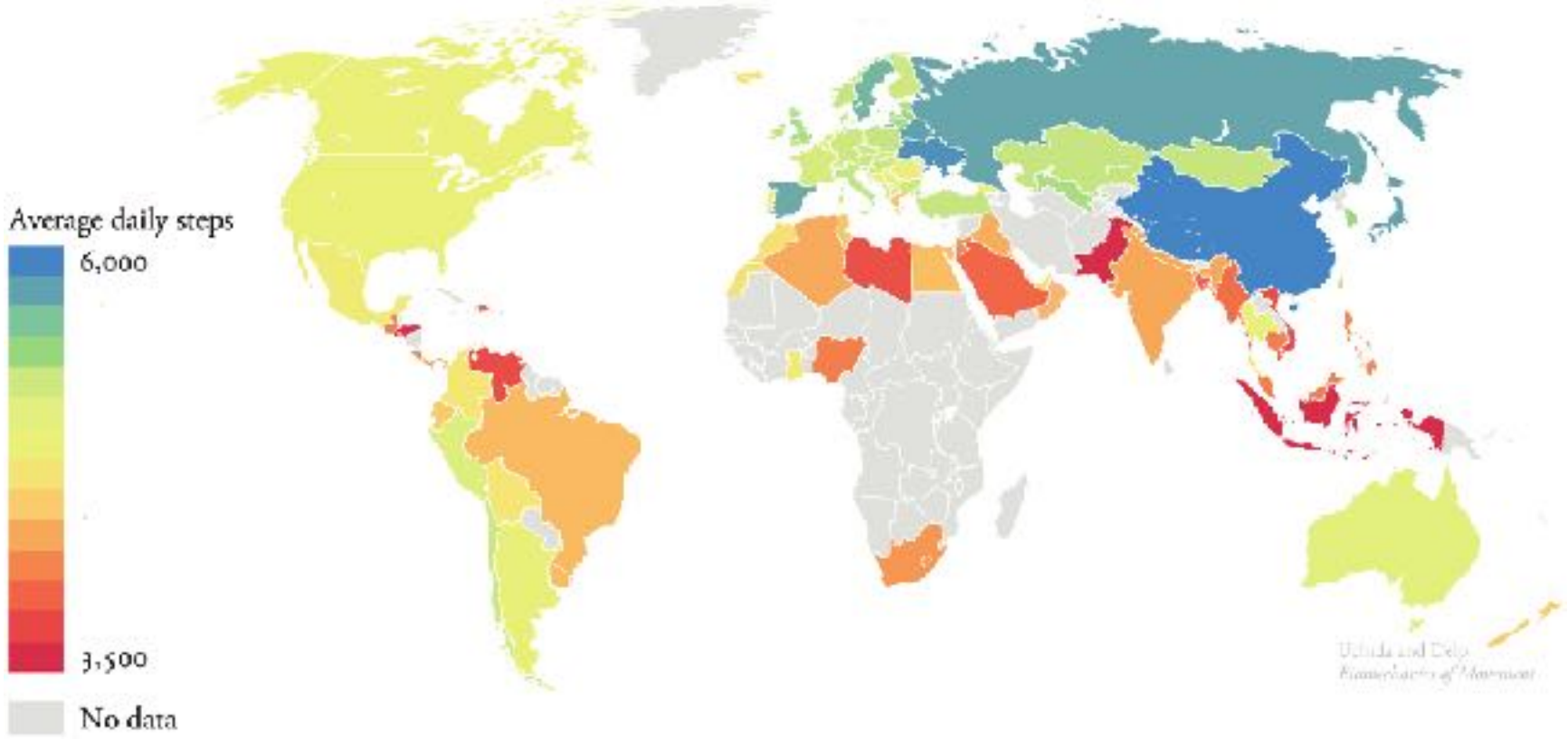
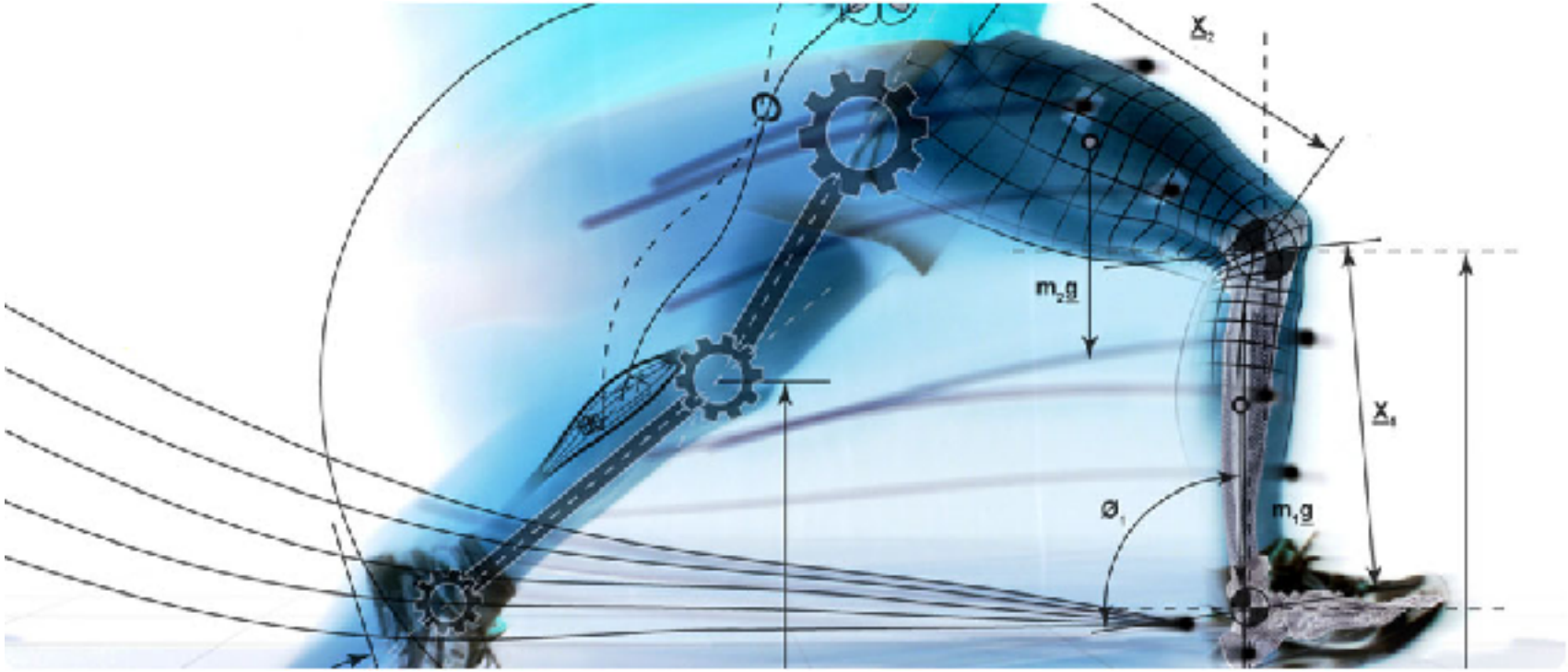
THE UNIVERSITY OF BRITISH COLUMBIA
School of Biomedical Engineering
Faculties of Applied Science and Medicine

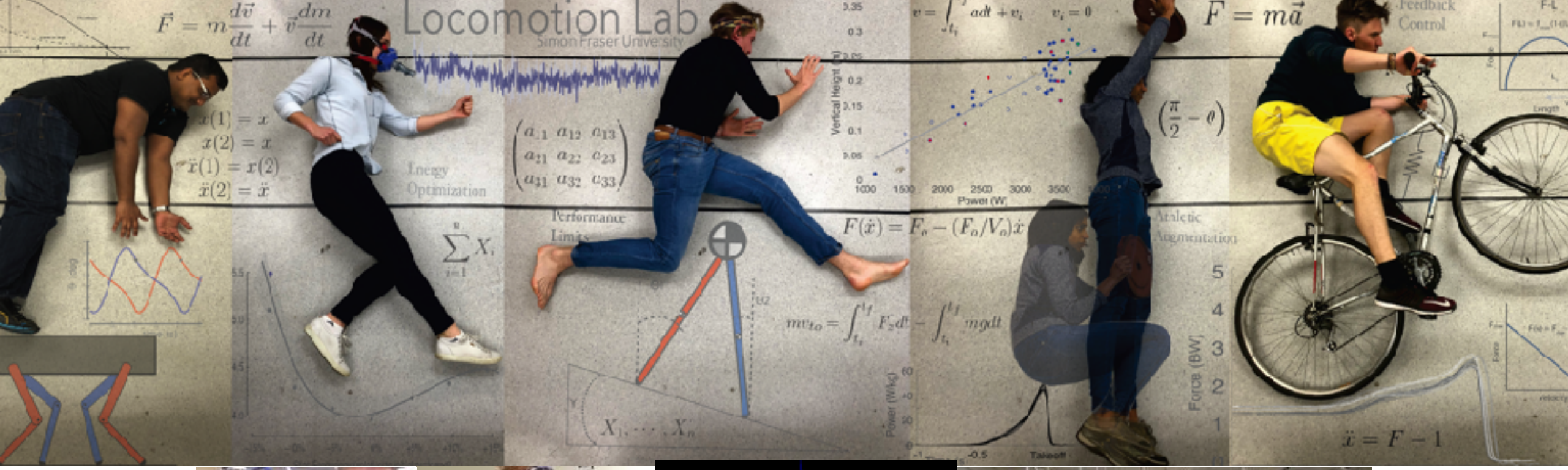
What is biomechanics?

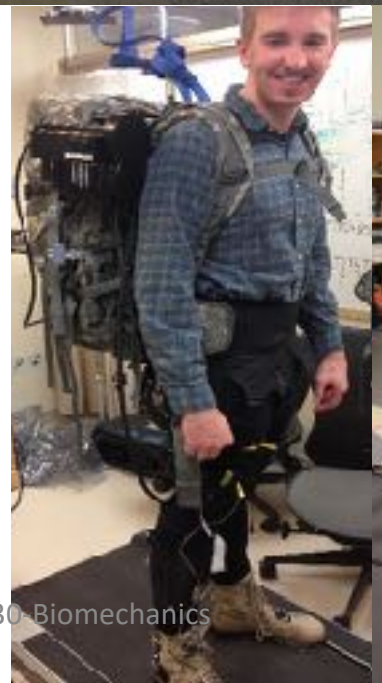


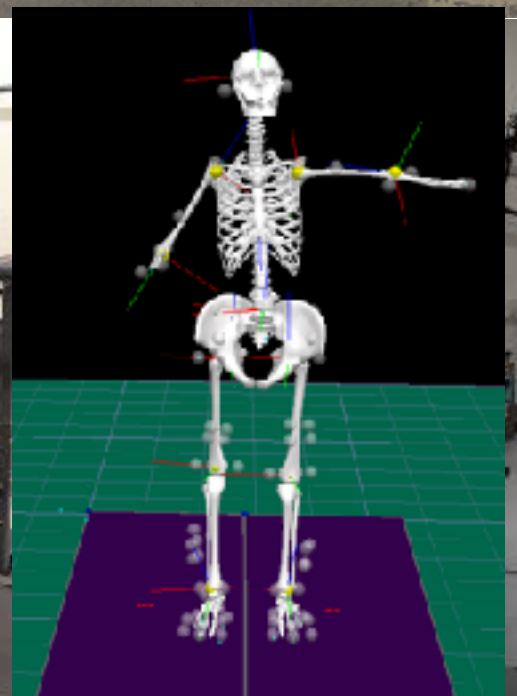
What is biomechanics?

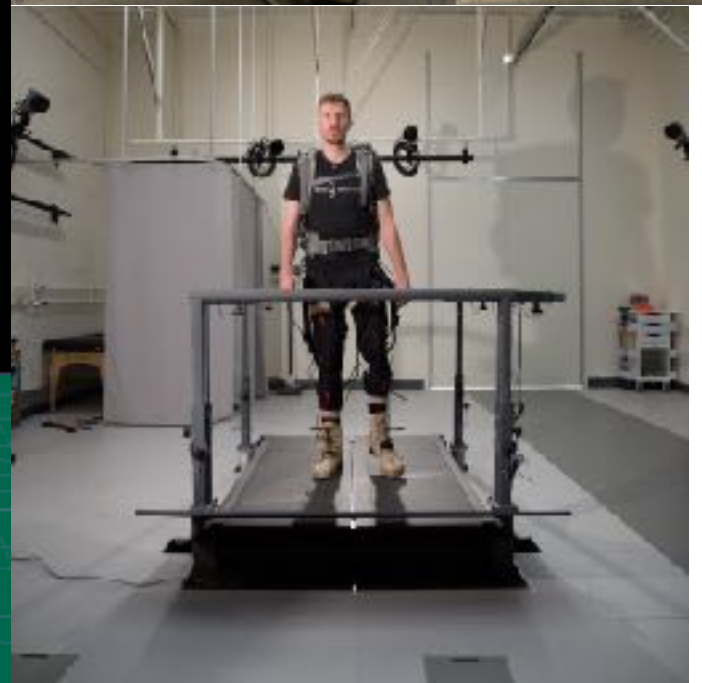
In biomechanics we aim to study and quantify the motion of body segments and the factors that influence that movement, the deformation of biological tissues and the factors that influence these deformations, and the biological effects of localized forces

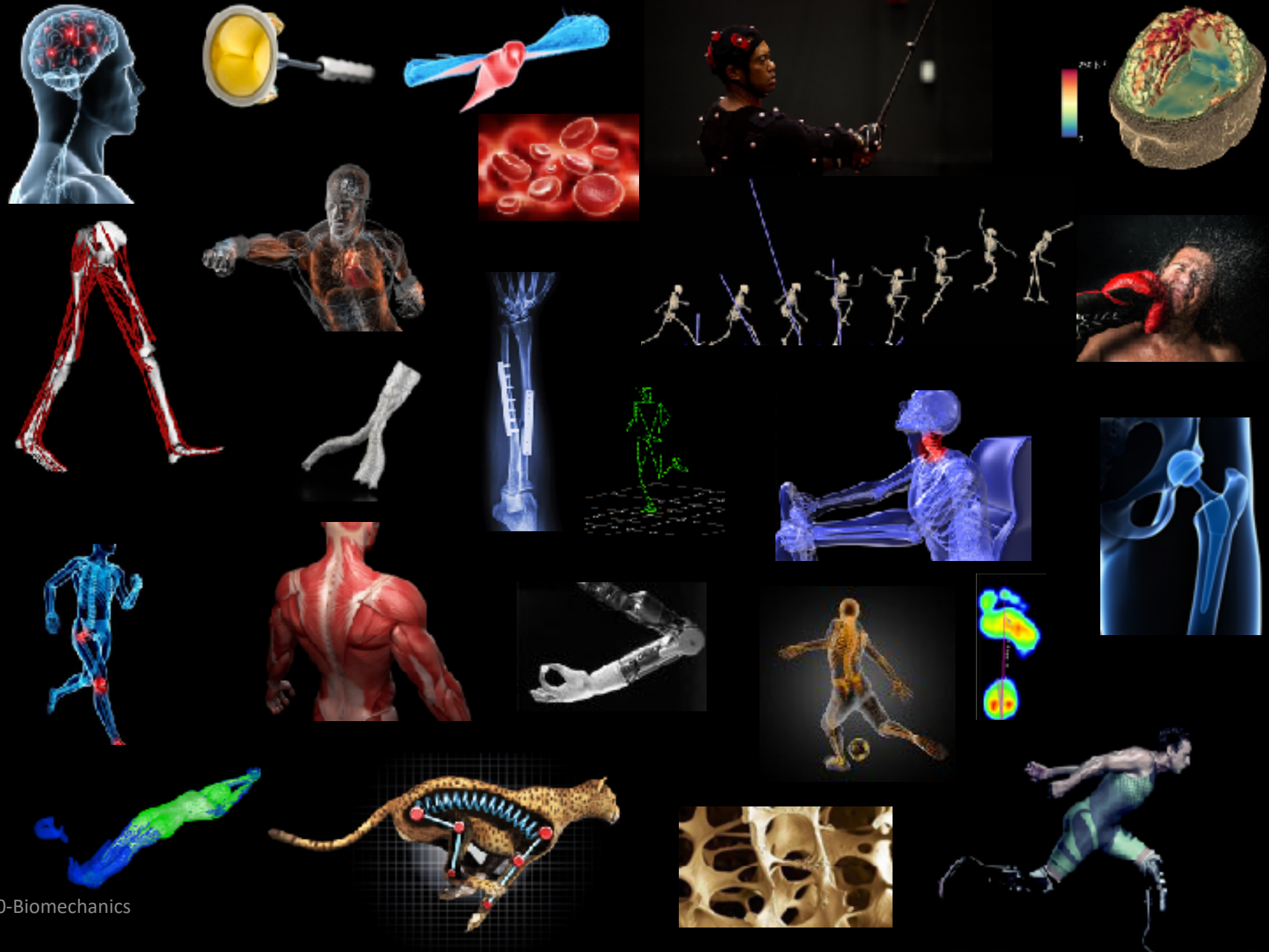



Locomotion Lab
Simon Fraser University
$\vec{F} = m\frac{d\vec{v}}{dt} + \vec{v}\frac{dm}{dt}$
$x(1) = x$
$x(2) = x$
$\ddot{x}(1) = x(2)$
$\ddot{x}(2) = \ddot{x}$
Energy Optimization
Performance Limits
$\sum_{i=1}^{n} X_i$
$F(\dot{x}) = F_o - (F_o/V_o)\dot{x}$
$mv_{to} = \int_{t_i}^{t_f} F_z dt - \int_{t_i}^{t_f} mg dt$
$X_1, \cdots, X_n$
$\vec{F} = m\vec{a}$
Feedback Control
$\left(\frac{\pi}{2} - \theta\right)$
Athletic Augmentation
$\ddot{x} = F - 1$
Vertical Height (m)
Power (W)
Force (BW)
Power (W/kg)
Takeoff









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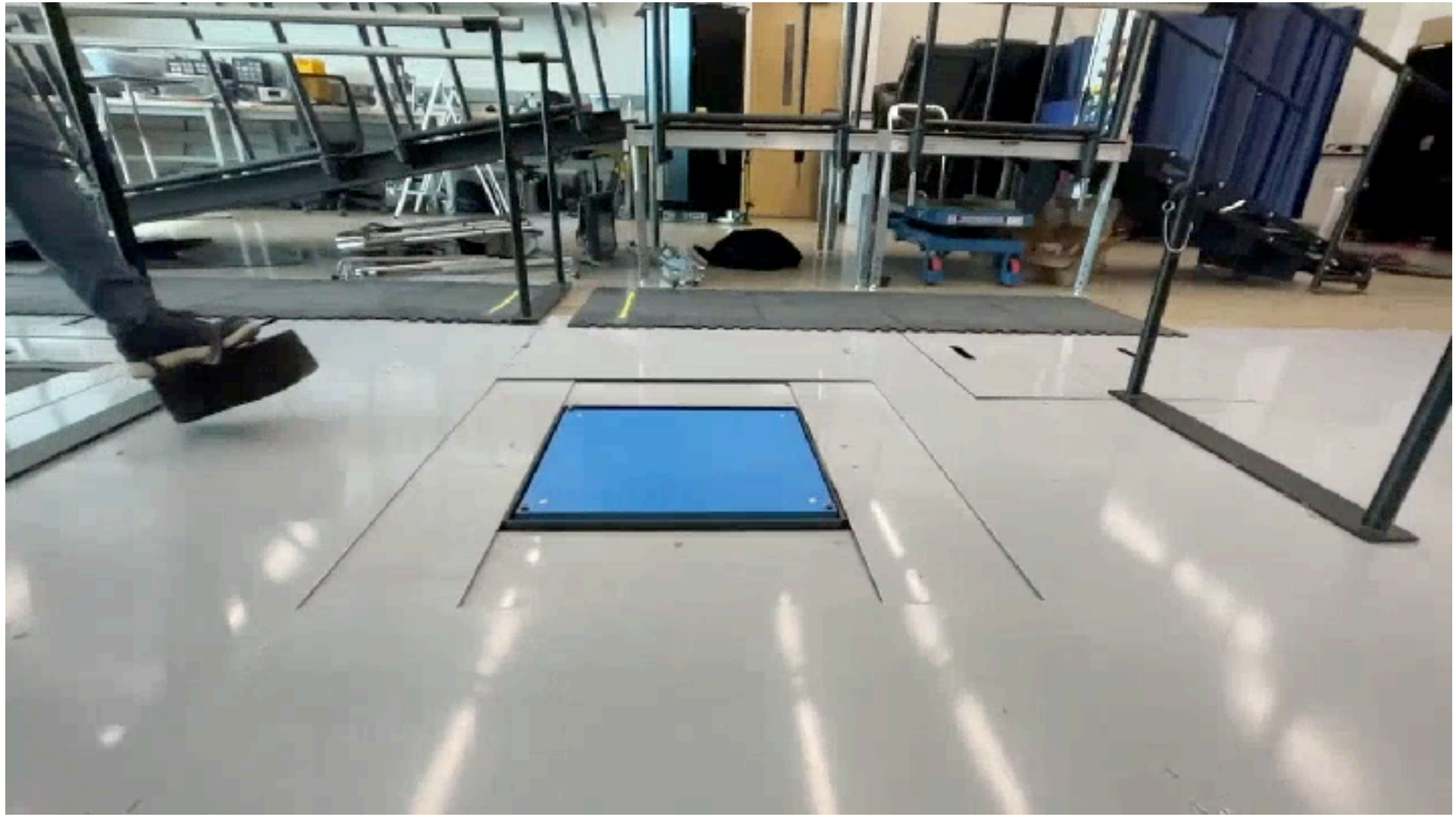

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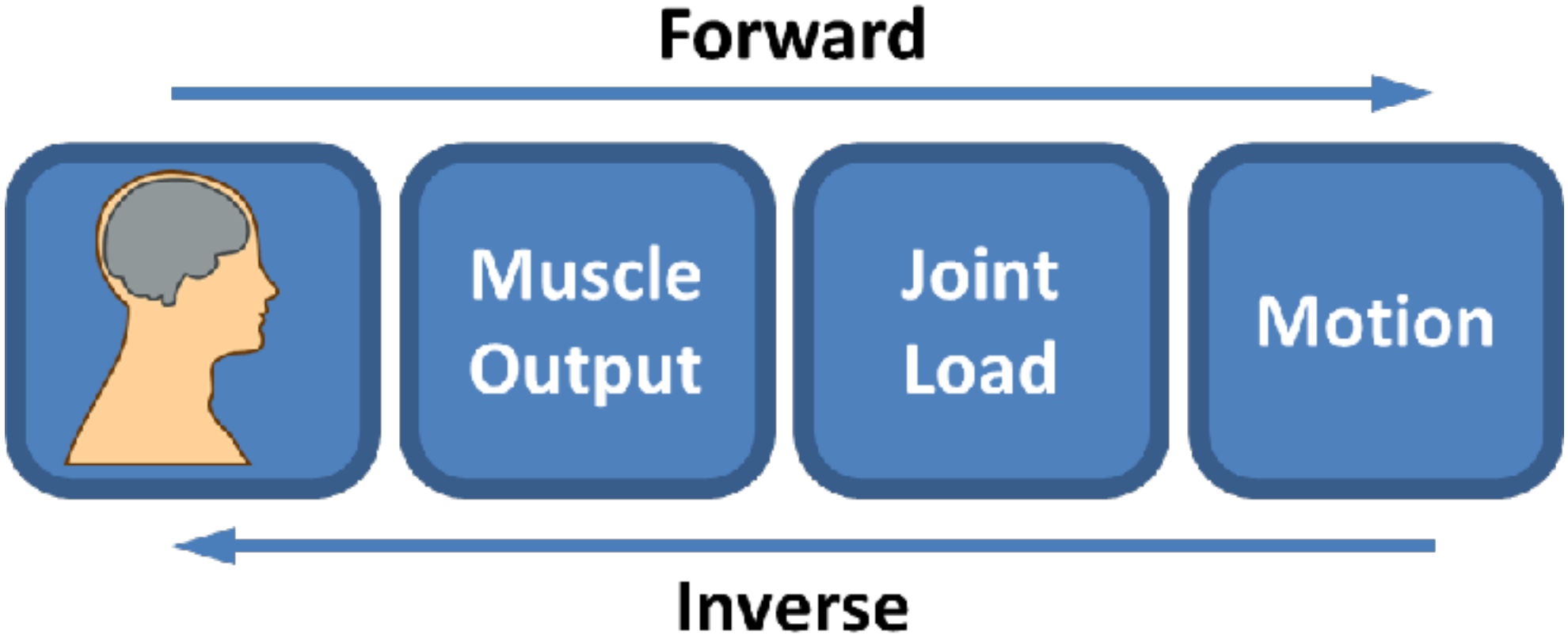


Careers

1.Wearables Engineer
2.Researcher in Biomechanics
3.Orthopedic Product Designer
4.Sports Equipment Designer
5.Clinical Biomechanist
6.Prosthetics and Orthotics Specialist
7.Ergonomics Consultant
8.Biomechanical Testing Engineer
9.Human Factors Engineer
10.Biomechanics Consultant
11.Sports Biomechanist
12.Gait Analyst
13.Biomechanical Modeling Specialist
14.Medical Device Engineer (with a focus on biomechanical devices)
15.Rehabilitation Engineer
16.Biomechanics Professor or Educator
17.Medicine
18.Programming


Bionic
Power


BROOKS


WEARTECH
LABS


WHOOP


PUMA


FORM


lab


QUALISYS
Motion Capture Systems


The
Moonshot
Factory


plantiga

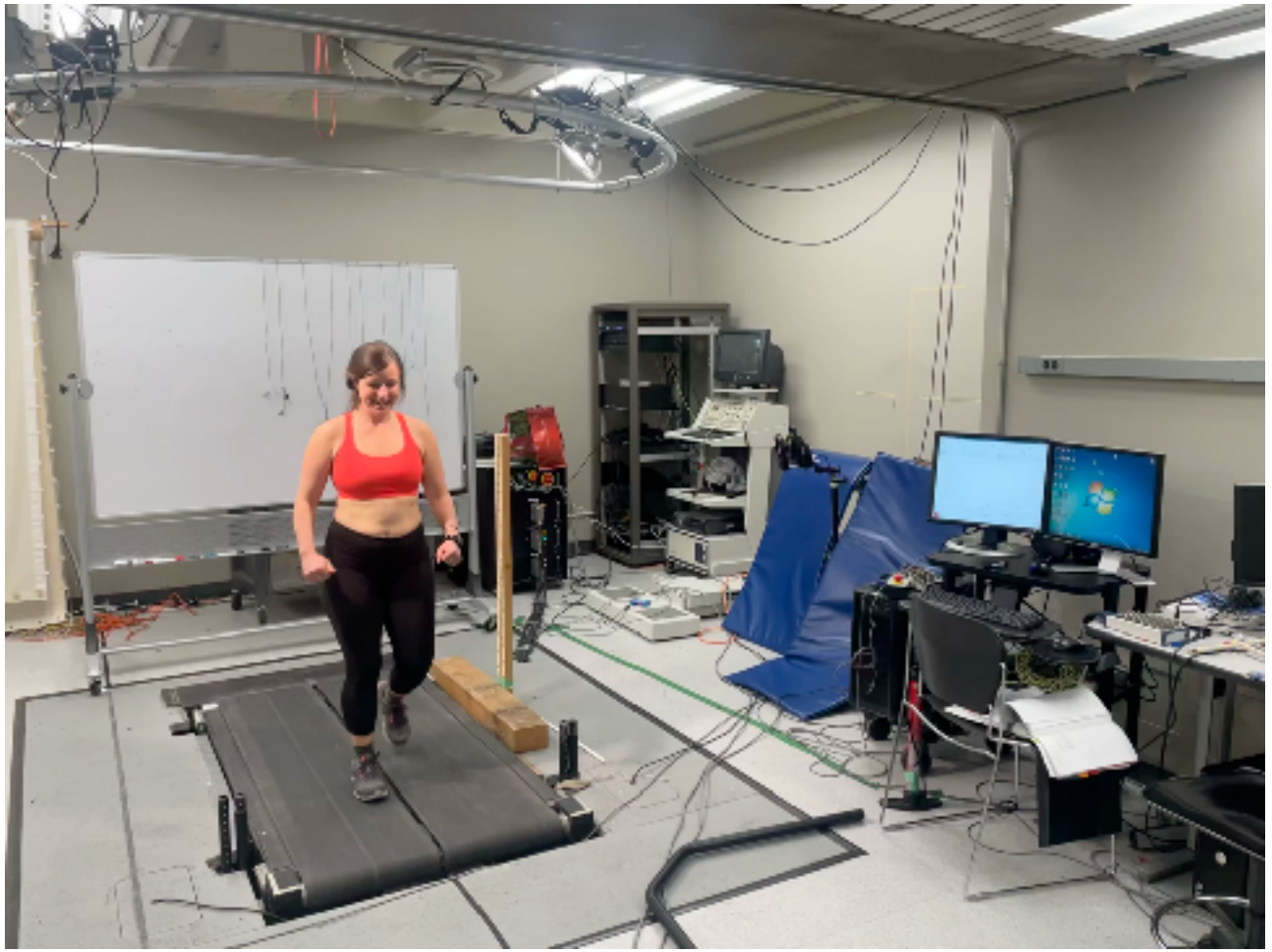

FACEBOOK
REALITY LABS


DELSYS


THEIA
Markerless

How I will strive to serve you

1. Develop great content to motivate you to learn and think beyond
2. Encourage first principle thinking
3. Navigating a biomechanics lab
4. Give you a skillset that well prepares you for the world of engineering
5. Inspire you to push outside your comfort zone!
6. Hands on material. -



General Course Objectives

- Develop an understanding of the fundamental principles in mechanics applied to the musculoskeletal system

- Learn about some of the equipment and sensors used to measure movement.

- Assumptions and limitations associated with the application of mechanics to the human body.

Grade Bounds

	Weight
Assignments *Total of 5*	15% (3% each)
Midterm Exams (2)	20% (10% each)
Final Exam	25% total
Laboratories *Group | 5 labs*	20% (4% each)
Project *Group work, end of term*	20% total

Save the Dates

Midterm # 1 (1.5 hours)

Tuesday Oct 8th | 915am – 1045am

Midterm # 2 (1.5 hours)

Thursday Nov 7th| 915am – 1045am

Final Exam Study Party | ~ 1 week before the exam

Final Exam | I will notify you as soon as I know the date. I have no control over this date.

Labs

The goal of these labs is to have fun and do interesting work.

- We expect you to bring rigor but also kindness and empathy.
- Please try to arrive 5 min before the lab organized and prepared to work.
- Engineering is about working as a part of a team. Try your best to do this. It may not always be easy.
- Labs are due 2 weeks after the lab via Canvas

Labs

- Groups, hands-on experiments
- Read the laboratory hand-out before the session.
- Lab reports are due two weeks from your lab.
- If you cannot make a lab, we will do our best to accommodate you but **give us advanced warning** if possible!

Lab 1 | Starting Week 2

- We check what lab section you are in. The labs and tutorials will be bi-weekly. **Tutorials are optional * but labs we take attendance**

		Lab / Tutorial				
		Monday	Tuesday	Wednesday	Thursday	Friday
Sept 2 - 6	Week 1					
Sept 9 -13	Week 2		L1D / L1A	L1B	L1C/L1E	
Sept 16- 20	Week 3		**T1D/T1A**	**T1B**	**T1C**	
Sept 23-27	Week 4		L1D / L1A	L1B	L1C/L1E	
Sept 30-Oct 4	Week 5		**T1D/T1A**	**T1B**	**T1C**	
Oct 7 - Oct 11	Week 6		L1D / L1A	L1B	L1C/L1E	
Oct 14 -18	Week 7		**T1D/T1A**	**T1B**	**T1C**	
Oct 21-25	Week 8		L1D / L1A	L1B	L1C/L1E	
Oct 28-Nov1	Week 9		**T1D/T1A**	**T1B**	**T1C**	
Nov 4 - Nov 8	Week 10		L1D / L1A	L1B	L1C/L1E	
Nov 11-15	Week 11	No Tutorials				
Nov 18-22	Week 12		L1D / L1A	L1B	L1C/L1E	
Nov 25-29	Week 13		**T1D/T1A**	**T1B**	**T1C**	
Dec 2-6	Week 14		L1D / L1A	L1B	L1C/L1E	

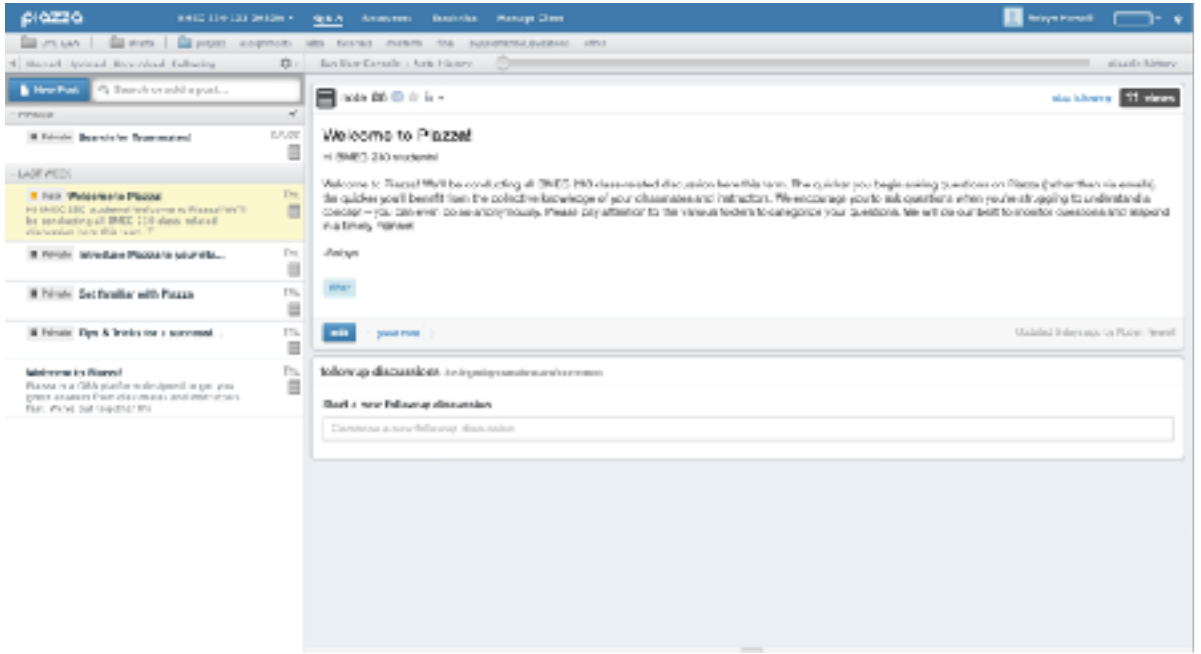
			Labs	
			Leading TA	**Support TA**
Tuesday	L1D	1-3pm	Douglas	Zamataro
Tuesday	L1A	3-5pm	Bonnor	Zamataro
Wednesday	L1B	2-4pm	Zamataro	Zaryan
Thursday	L1C	11-1pm	Zaryan	Bonnor
Thursday	L1E	430-630pm	Bonnor	Douglas
			Leading TA	
Tuesday	L1D	1-3pm	Douglas	
Tuesday	L1A	3-5pm	Bonnor	
Wednesday	L1B	2-4pm	Zamataro	
Thursday	L1C	11-1pm	Zaryan	
Thursday	L1E	430-630pm	Douglas	

Piazza | Important **

Use this first for questions regarding assignments, labs, projects, test prep, general, etc. Use the categories to target the appropriate TA or myself for the question.

Please be reasonable about turn-around time expectations!

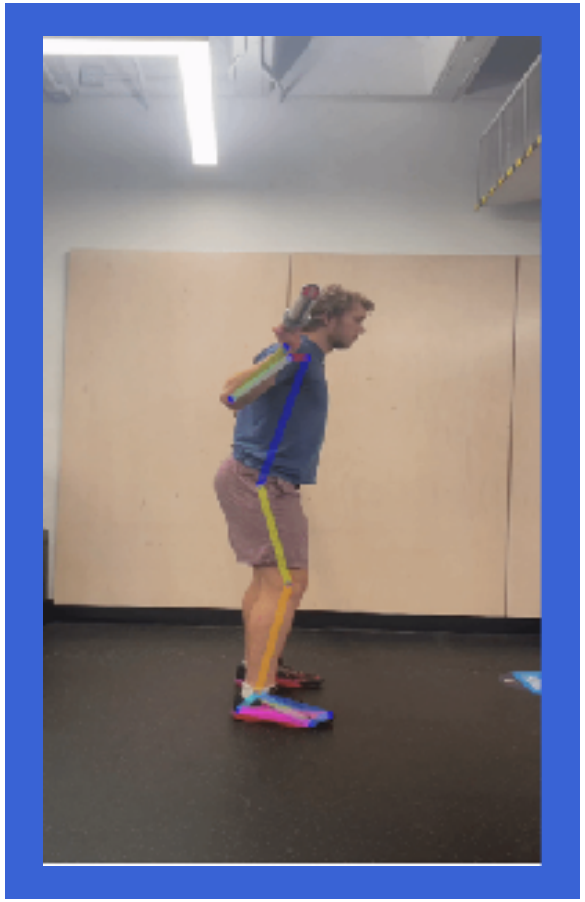
Don't expect answers to assignment questions 1 hour before it is due!!!

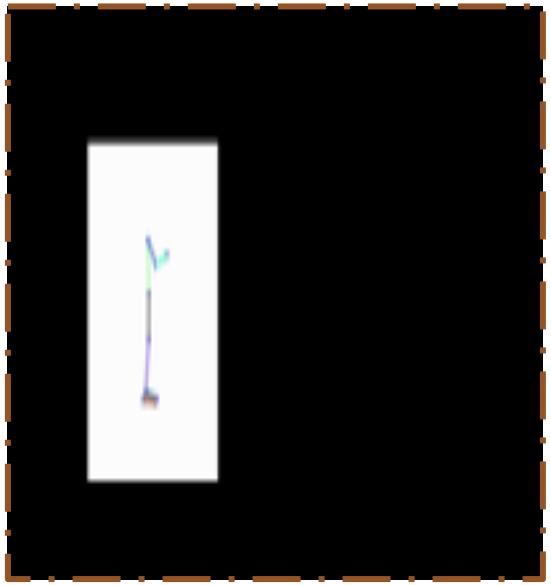


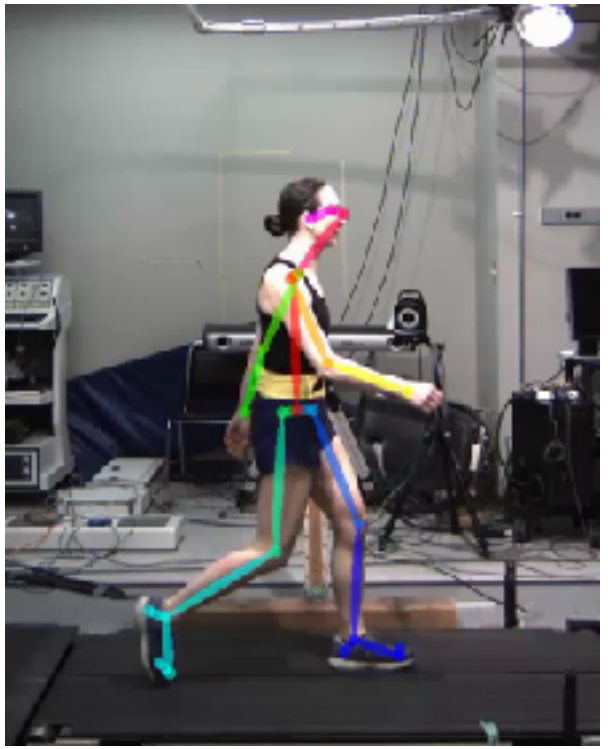
Project

Pitch: Biomechanical device to augment or restore human performance.

You will use computer vision, biomechanics, and engineering design to pitch an idea. More to come







Emailing Me:

I will try my best to reply to all of your emails within 24 hours.

But Piazza may be more suited for common questions. Please post here first.

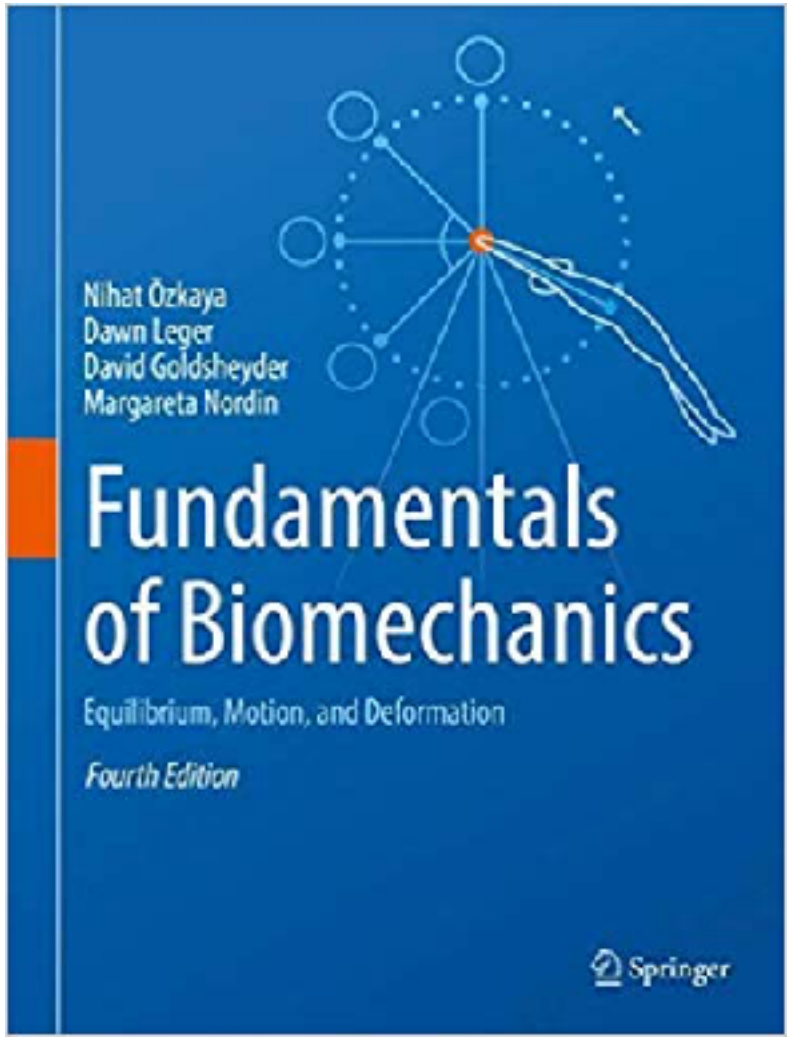
If you are emailing me please follow this basic format :

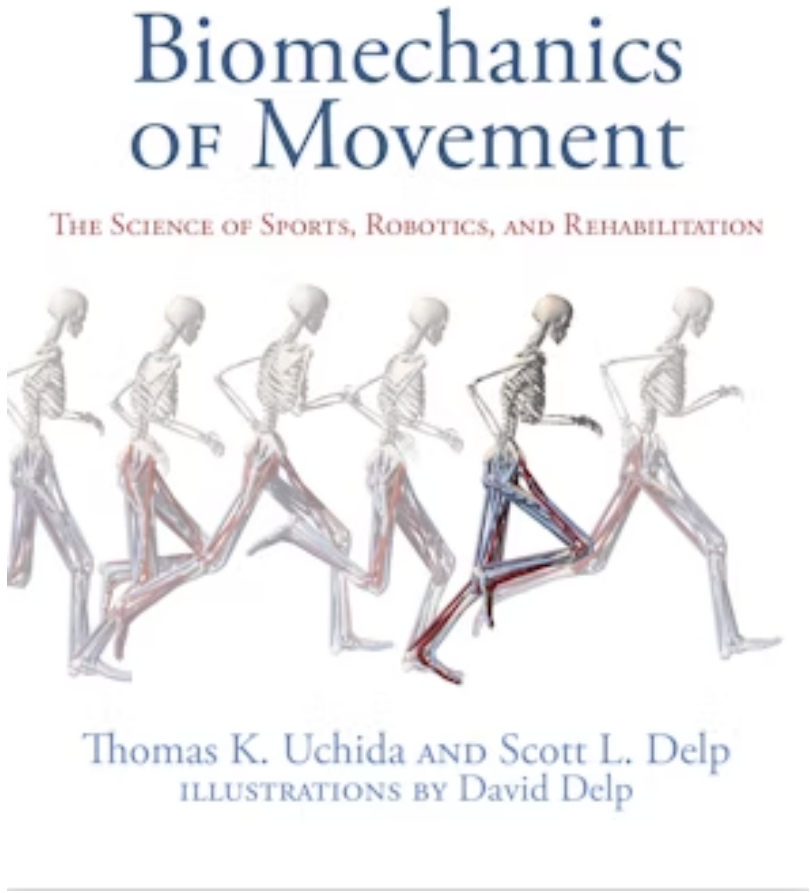
Subject : BMEG 230 Question

Hi my name is XX. I have XX questions.

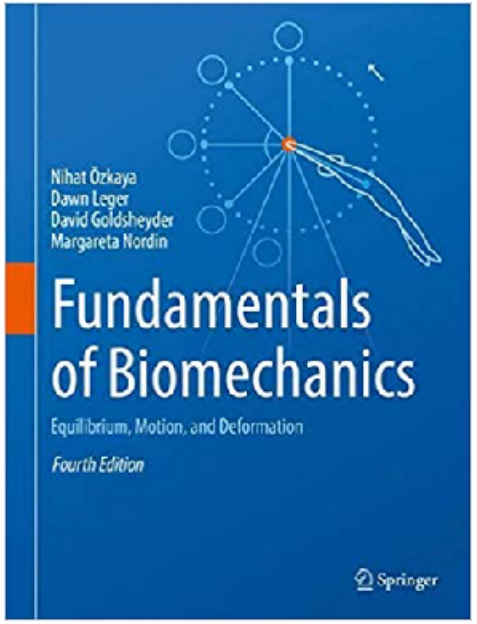
…….

Textbooks I will refer too*



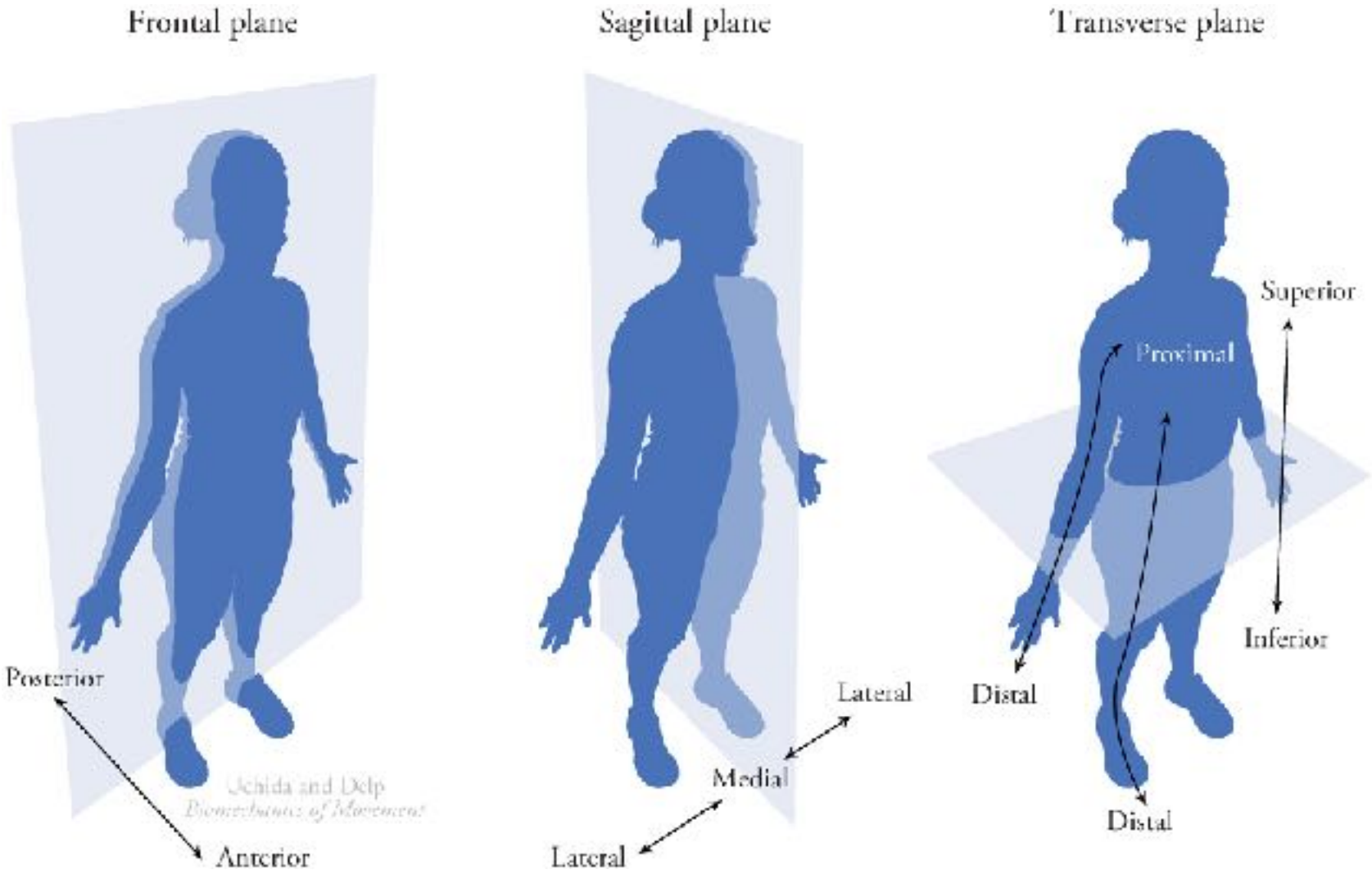


Recommend Readings for Midterm #1 *



Note: please be aware of the known errors in the course text
https://www.ele.uri.edu/faculty/vetter/BME207/textbook-errors-4th-ed.pdf

These terms should become second nature*



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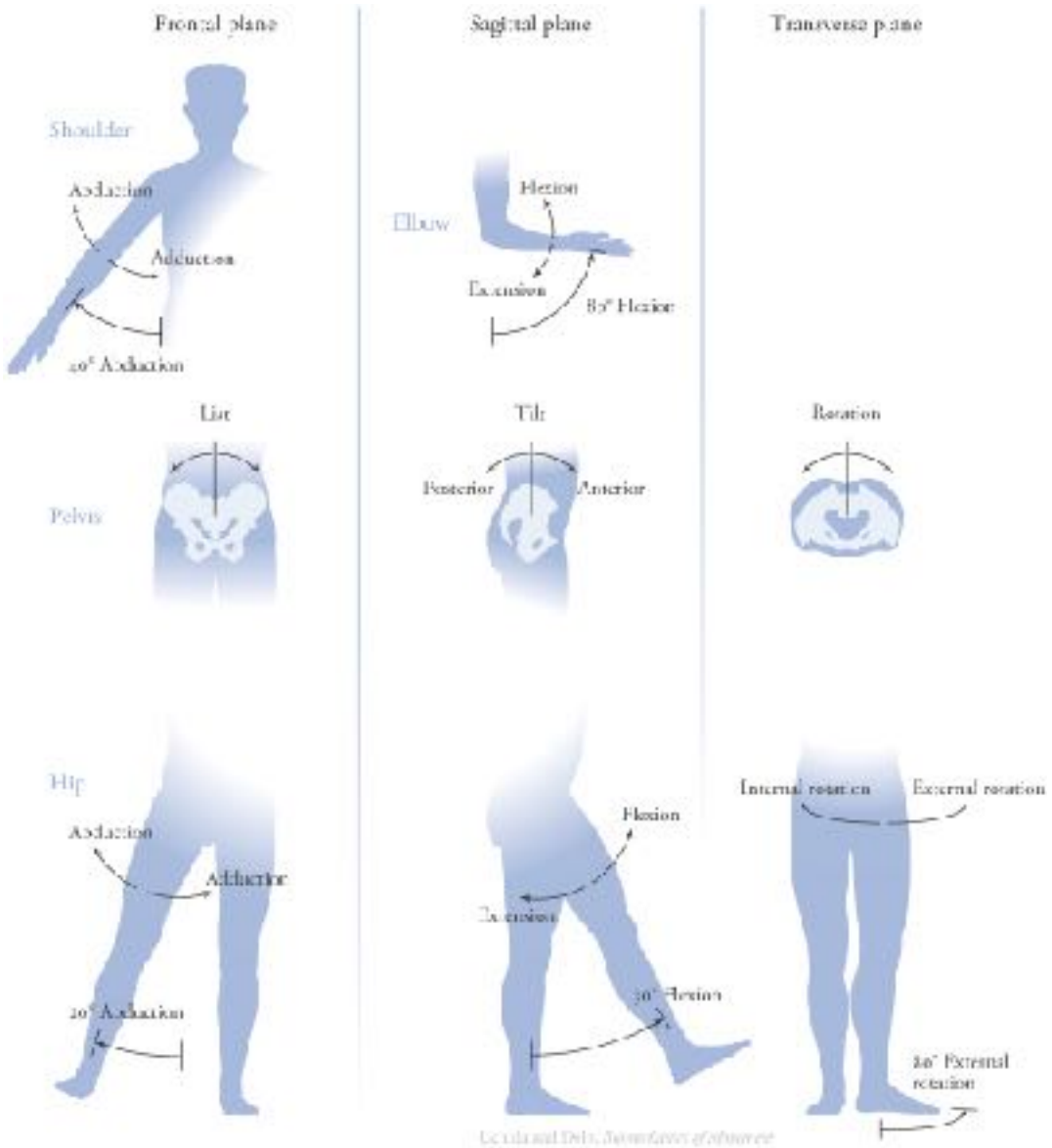

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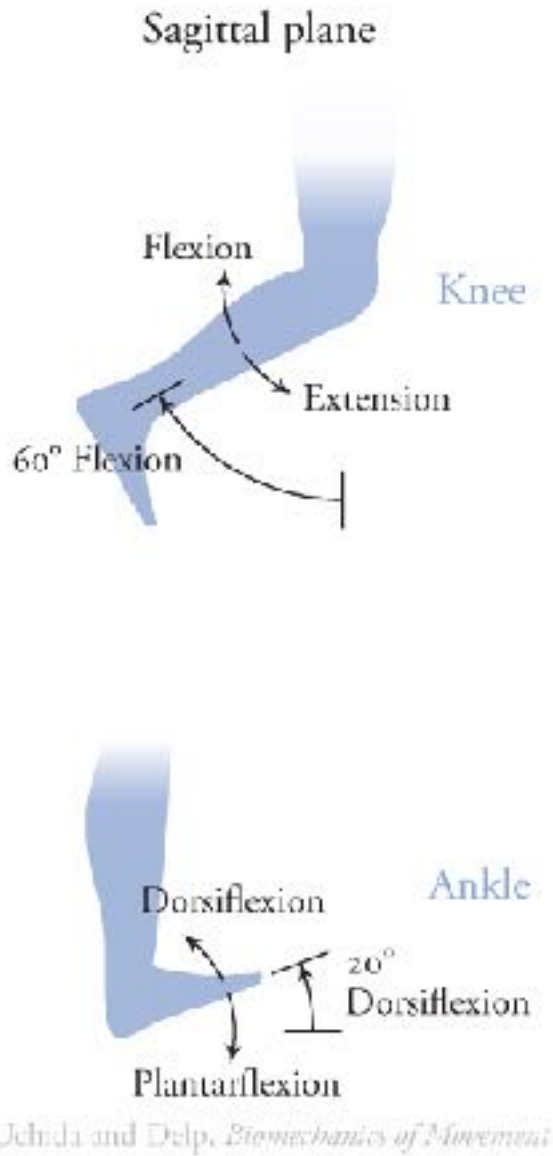
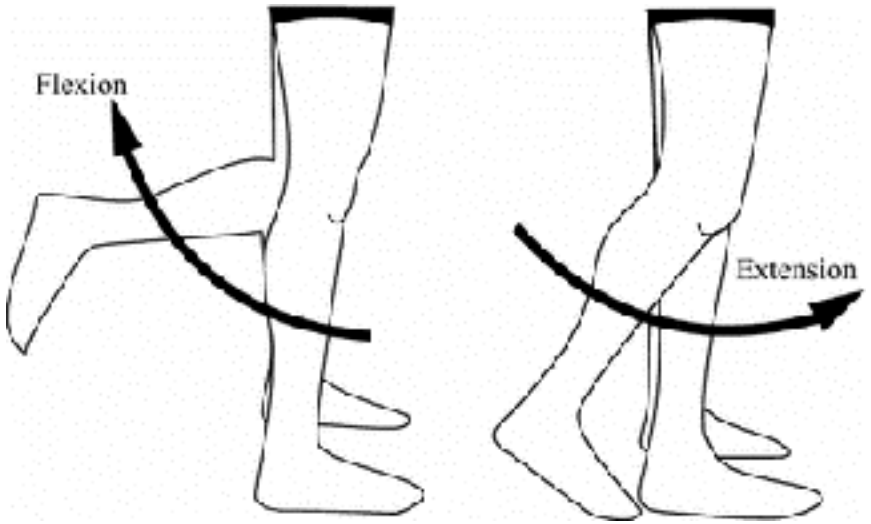
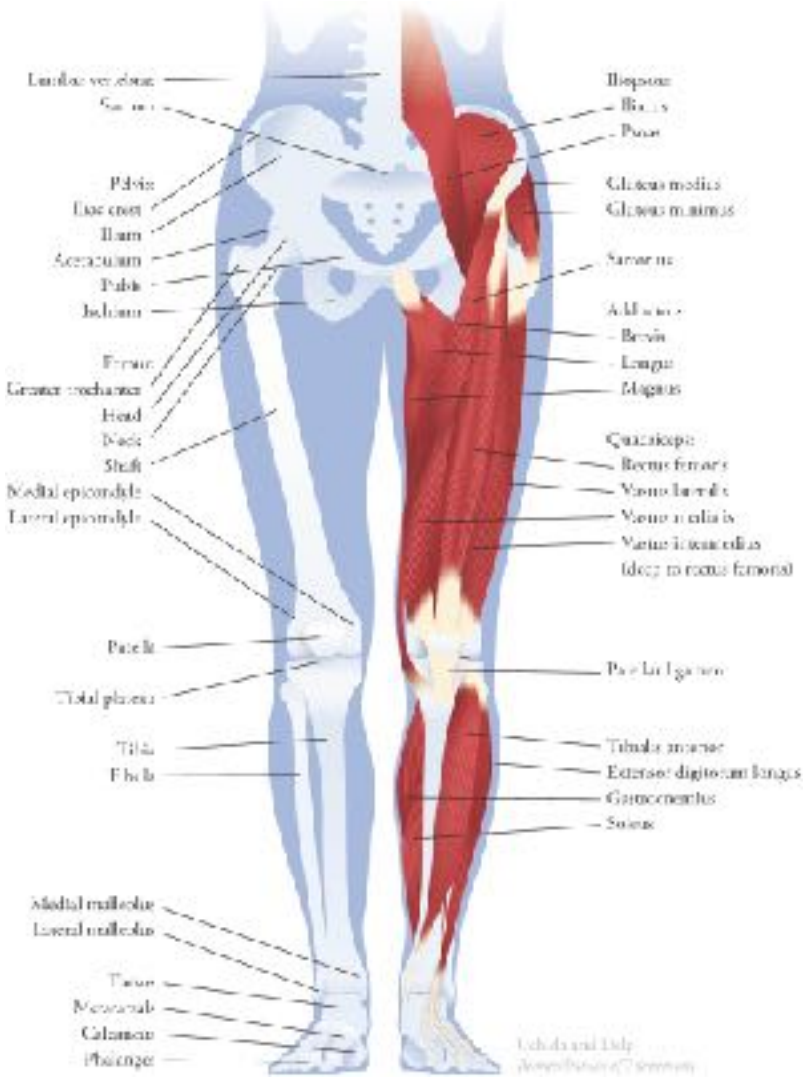




You do not need to memorize these*



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