Kinesiology 351: Mechanical Properties of Tissues

Summary

The objective of this course is to provide the opportunity to explore the mechanics of muscular contraction and to examine how the mechanical properties of the muscle work synergistically with tendons, bones and ligaments. Practical applications (training & clinical) of key concepts will be discussed in class. Electromyography, a recording of the electrical activity associated with contracting muscles, will be used in laboratory to explore concepts discussed in class.

Lectures: Tuesday and Thursday, 14h – 15h, WOOD-6
Tutorials: Tuesday and Thursday, 15h – 15h30, WOOD-6
Labs: Tuesday (10h), Tuesday (12h), Tuesday (17h), Thursday (12h)
          All labs are held in Osborne Gym G (Undergraduate Teaching Lab).
Instructor: Dr. Jean-Sébastien Blouin, Copp building room 3003A
Teaching Assistants: Geoffrey McKendry and Anthony Chen

Prerequisites:

School of Kinesiology Core and third-year standing.

Required Reading

Review of biomechanical definitions provided on the web site (Connect)
Readings: Lecture notes provided on the web site (Connect).
On-line reading material provided on the web site (Connect).

Optional Readings available at the Library

Title: Skeletal Muscle Structure, Function & Plasticity
Author: Richard Lieber
Title: Neuromechanical Basis of Kinesiology
Author: Roger Enoka
Title: Low Back Disorders - Evidence-Based Prevention and Rehabilitation
Author: Stuart M McGill
Title: Basic Biomechanics of the Skeletal System
Authors: Margareta Nordin and Victor Frankel

Course Learning Objectives

1. Demonstrate a conceptual understanding of the elements of the human musculoskeletal system and how their properties interact during human movement.
2. Be able to use the concepts of force-length, force-velocity, hysteresis, compression, tension, shear, stress, strain, Young's Modulus to explain musculoskeletal adaptation.
3. Apply knowledge of anatomy to describe human movement and motor skills in both anatomical and mechanical terms.
4. Become familiar with the interaction of the mechanical properties of the musculoskeletal system as they affect human movement and relate these properties to real-world applications.
5. Be able to apply surface electromyography electrodes over appropriate anatomical landmarks and record from muscles during human movements.
6. Become familiar with the conceptual framework for analysis of human movement and understand the physiological and biomechanical basis for recording electrical potentials from striated muscles using surface electrodes.
7. Have demonstrated personal and social responsibility towards class and laboratory participation.
8. Be able to facilitate active learning, critical thinking, and problem solving skills in the qualitative analysis of human musculoskeletal system.

Course Content

Week 1 (Jan 3 & 5): Introduction, Definition of biomechanical concepts

Week 2 (Jan 10 & 12): Mechanical properties of bone and muscle & Introduction to muscle structure and function

Week 3 (Jan 17 & 19): Electromyography & Force-length relationship

Week 4 (Jan 24 & 26): Force-velocity relationship & Current topics on muscle mechanics

Week 5 (Jan 31 & Feb 2): Manuscripts review in class & Muscle fatigue

Week 6 (Feb 7 & 9): & Muscle length, muscle moment arm & joint geometry

Week 7 (Feb 14 & 16) Review/Tutorial & Midterm (Feb 16)

Week 8: Reading Week


Week 10 (March 7 & 9): Lumbar spine: Anatomy, Biomechanics and Low back pain.

Week 12 (Mar 21 & 23): Electromechanical delay and biomechanics of biarticular muscles & Lab exam (Mar 23)

Week 13 (Mar 28 & 30): Invited Speaker: Forensic Biomechanics | Smart Car seat & Muscle force estimation and measurement

Week 14 (April 4 & 6): Whiplash injury & Review

Course Structure

The *lecture component* will be two 60-minute seminars. The seminars will include lecturing, invited speakers and discussions around pre-assigned topics. Students will be requested to prepare for these discussions with readings posted on Connect before the beginning of the course. Each lecture will be followed by *tutorials*. Students are encouraged to attend the tutorials and ask questions about the lecture material.

The *laboratory component* will include three formal labs and tutorials when no labs are scheduled. Student attendance to all formal labs is mandatory. Material presented in all four labs will be subjected to examination. Students are encouraged to attend the laboratory tutorials and ask questions about the laboratory material.

**IMPORTANT DATES**
- Lab 1 – Force, Moment and Balance: Week 3 (Jan 17-19)
- Lab 2 – Muscle fatigue – Force-EMG: Week 6 (Feb 7-9)
- Lab 3 – Lumbar Spine: Flexion-relaxation phenomenon: Week 10 (Mar 7-9)

Labs will be performed in groups of 5 or 6 students. All students are expected to participate equally to the labs. If a team does not function well, they have to contact the Teaching Assistants to discuss the issues.

Tutorials will be offered on the following weeks: Week 4, Week 5, Week 7, Week 9, Week 10, Week 11, Week 12 & Week 13.

**WITHDRAWAL DATES**

Last day to withdraw without a W standing : January 17, 2017

Last day to withdraw with a W standing
(course cannot be dropped after this date) : February 10, 2017
Course Participation: personal and social responsibility

As there are lab sections and group discussions in this course, students are expected to participate actively in these activities and demonstrate leadership, critical contribution, interpersonal skills, support activities, punctual attendance, on-time completion of class activities, positive attitude and effort according to the following schedule.

Evaluation Profile

<table>
<thead>
<tr>
<th>Learning objective</th>
<th>Methods (all required)</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>1, 2, 3, 4, 7</td>
<td>Written examinations (2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mid-term (Feb 16)</td>
<td>30</td>
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<td></td>
<td>Final</td>
<td>50</td>
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<tr>
<td>5, 6, 7, 8</td>
<td>Laboratories</td>
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<td></td>
<td>Attendance</td>
<td>5</td>
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<tr>
<td></td>
<td>Written laboratory exam (Mar 23)</td>
<td>15</td>
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<tr>
<td>Total</td>
<td></td>
<td>100 marks</td>
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Important Note: If you miss the Mid-term or Lab exam for a valid reason, the marks will be transferred to the Final exam.

Attendance: Regular attendance is expected of students in all their classes (including lectures, laboratories, tutorials, seminars, etc.). Students who neglect their academic work and assignments may be excluded from the final examinations. Students who are unavoidably absent because of illness or disability should report to their instructors on return to classes.

The University accommodates students with disabilities who have registered with the Disability Resource Centre. The University accommodates students whose religious obligations conflict with attendance, submitting assignments, or completing scheduled tests and examinations. A list of religious holidays involving fasting, abstention from work or study, or participation in all-day or fixed-time activities is available at http://students.ubc.ca/publications/multifaith/. Please let your instructor know in advance, preferably in the first week of class, if you will require any accommodation on these grounds. Students who plan to be absent for varsity athletics, family obligations, or other similar authorized commitments, cannot assume they will be accommodated, and should discuss their commitments with the instructor before the drop date.

Academic Dishonesty: Please review the UBC Calendar “Academic regulations” for the university policy on cheating, plagiarism and other forms of academic dishonesty. Also visit www.arts.ubc.ca and go to the students’ section for useful information on avoiding plagiarism and on correct documentation.

Students should retain a copy of all submitted assignments (in case of loss) and should also retain all their marked assignments in case they wish to apply for a Review of Assigned Standing. Students have the right to view their marked examinations with their instructors, providing they apply to do so within a month of receiving their final grades. This review is for pedagogic purposes. The examination remains the property of the university.