



SCHOOL OF KINESIOLOGY
THE UNIVERSITY OF BRITISH COLUMBIA

Kinesiology 316: Mechanical Properties of Tissues
(formerly KIN351)

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.

Tuesdays: 14h – 15h30 Synchronous lectures on Canvas (Collaborate Ultra)
Thursdays: 14h – 15h30 Programming activities & Tutorials (Collaborate Ultra)

Additional tutorials: Tuesdays 9h – 10h PT and 16h30 – 17h30 PT

Instructor: Jean-Sébastien Blouin
Teaching Assistants: Jiyu Wang and Reza Partovi

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). The on-line reading material includes excerpt from:

- 1- Whiting WC, Zernicke RF (1998) Biomechanics of musculoskeletal injury. Chapter 3 pp. 41-85.
- 2- Lieber RL (2002) Skeletal Muscle Structure, Function & Plasticity. Chapter 2 pp 45-112 & Chapter 3 pp 113-172.
- 3- McGill SM (2008) Low Back Disorders - Evidence-Based Prevention and Rehabilitation. Chapters 4 & 5 pp 35-112

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 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. Become familiar with the conceptual framework for analysis of human movement and understand the physiological and biomechanical basis for recording electrical potentials from skeletal muscles using surface electrodes.
6. Demonstrate an understanding of basic computer programming concepts.
7. Have demonstrated personal and social responsibility towards class and tutorial participation.
8. Be able to facilitate active learning, critical thinking, and problem solving skills in the analysis of human musculoskeletal system.

Course Content (and tentative schedule)

Introduction to Computer Kinesiology (Jan 12 &14): Introduction to Matlab and onramp activities

Module 1 (Jan 19 & 26): Biomechanical concepts

Ref: Whiting WC, Zernicke RF (1998) Biomechanics of musculoskeletal injury. Chapter 3 pp. 41-85.

Module 2 (Feb 2): Introduction to muscle structure and function

Ref: Lieber RL (2002) Skeletal Muscle Structure, Function & Plasticity. Chapter 2 pp 45-112.

Module 3 (Feb 9): Electromyography

Reading Week (Feb 15-19)

Modules 4 & 5 (Feb 23): Force-length relationship & Force-velocity relationship

Ref: Lieber RL (2002) Skeletal Muscle Structure, Function & Plasticity. Chapter 2 pp 45-112.

Module 6 (Mar 2): Current topics on muscle mechanics

Midterm (Mar 4)

Module 7 (Mar 9): Muscle length- joint geometry

Ref: Lieber RL (2002) Skeletal Muscle Structure, Function & Plasticity. Chapter 3 pp 113-172.

Module 8 (Mar 16): Muscle moment arm & joint geometry

Ref: Lieber RL (2002) Skeletal Muscle Structure, Function & Plasticity. Chapter 3 pp 113-172.

Module 9 (Mar 23 & 30): Lumbar spine: muscle anatomy and physiology & Introducing the tendon: Structure and function.

Ref: McGill SM (2008) Low Back Disorders - Evidence-Based Prevention and Rehabilitation. Chapters 4 & 5 pp 35-112.

Module 10 (Apr 6): Introducing the tendon: Structure and function & Electromechanical delay

Ref: Lieber RL (2002) Skeletal Muscle Structure, Function & Plasticity. Chapter 3 pp 113-172

Module 11 (Apr 13): Biomechanics of biarticular muscles and muscle force measurement

Ref: Lieber RL (2002) Skeletal Muscle Structure, Function & Plasticity. Chapter 3 pp 113-172

Review/Tutorial (April 13)

Course Structure

Tuesday: synchronous lecture. The *lecture component* will be a single 80-minute synchronous seminar per week on Tuesdays. The weekly seminars will include lecturing, quizzes and discussions around pre-assigned topics. Students will be requested to prepare for these discussions with readings posted on Canvas before the beginning of the course.

Thursday: programming activity & tutorials. There will be five computer programming activities throughout the term. Programming activities will be interleaved with tutorials. The objective of these activities is to introduce students to computer programming. The data analysis concepts will be applicable to any type of data and emphasize certain theoretical concepts discussed in the lectures. To obtain full marks for the programming activities (20), students are required to submit the programming activities on Canvas by the provided deadline. Any late submission will result in a 10% penalty per day.

Schedule for the programming activities:

Activity 1: Center of pressure (Jan 21). Tutorial on Jan 28. Due date: Feb 1.

Activity 2: Load-deformation (Feb 4). Tutorial on Feb 11. Due date: Feb 15.

Activity 3: Force-length-velocity relationship (Feb 25). Tutorial on Mar 11. Due date: Mar 15.

Activity 4: Flexion-relaxation phenomenon (Mar 18). Tutorial on Mar 25. Due date: Mar 29.

Activity 5: Electromyography (Apr 1). Tutorial on Apr 8. Due date: Apr 12.

All programming activities are due at 23h59 PST.

We will also offer guided *tutorials* every week on Tuesdays 9h – 10h and 16h30 – 17h30. This will provide an opportunity to address questions, perform targeted activities related to lecture material and provide support for the programming activities. Students are encouraged to attend all tutorials and ask questions about any material.

WITHDRAWAL DATES

Last day to withdraw without a W standing : January 22, 2021

Last day to withdraw with a W standing
(course cannot be dropped after this date) : March 12, 2021

Course Participation: personal and social responsibility

As there are tutorials 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

<i>Learning objective</i>	<i>Methods (all required)</i>	<i>Value</i>
1, 2, 3, 4, 7	Written examinations (2)	
	<i>Mid-term (Mar 4)</i>	30
	<i>Final</i>	50
5, 6, 7, 8	Tutorials and programming	
	<i>Programming activities (5)</i>	20
	Total	100 marks

Important Notes: If you miss the Mid-term 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, 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.

Instructor's Technology Failing During Synchronous Meetings

If the instructor's technology or internet connection fails during a synchronous meeting please carry on with the activity you are working on or if course content is being delivered please wait up to fifteen minutes or to the end of the scheduled class time (whichever comes first) to allow the instructor to resolve the issue. If the issue is not resolved within the outlined time period than students are free to 'leave' the Collaborate Ultra classroom and the instructor will follow up in a Canvas course announcement with next steps.

UNIVERSITY POLICIES

Academic Honesty and Standards

Academic honesty is essential to the continued functioning of the University of British Columbia as an institution of higher learning and research. All UBC students are expected to behave as honest and responsible members of an academic community. Breach of those expectations or failure to follow the appropriate policies, principles, rules, and guidelines of the University with respect to academic honesty may result in disciplinary action.

It is the student's obligation to inform themselves of the applicable standards for academic honesty. Students must be aware that standards at the University of British Columbia may be different from those in secondary schools or at other institutions. If a student is in any doubt as to the standard of academic honesty in a particular course or assignment, then the student must consult with the instructor as soon as possible, and in no case should a student submit an assignment if the student is not clear on the relevant standard of academic honesty.

If an allegation is made against a student, the Registrar may place the student on academic hold until the President has made his or her final decision. When a student is placed on academic hold, the student is blocked from all activity in the Student Service Centre.

Resources to Support Student Success

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the [UBC Senate website](#).

Academic Accommodation for Students with Disabilities

The University of British Columbia recognizes its moral and legal duty to provide academic accommodation. The University must remove barriers and provide opportunities to students with a disability, enabling them to access university services, programs, and facilities and to be welcomed as participating members of the University community. The University's goal is to ensure fair and consistent treatment of all students, including students with a disability, in accordance with their distinct needs and in a manner consistent with academic principles.

Students with a disability who wish to have an academic accommodation should contact Centre for Accessibility without delay.

Copyright

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copyright holder(s) constitutes a breach of copyright and may lead to academic discipline. Students are not permitted to record classes or take photographs during class unless they are granted prior permission from the instructor.

Students Learning Outside of Canada

During this pandemic, the shift to online learning has greatly altered teaching and studying at UBC, including changes to health and safety considerations. Keep in mind that some UBC courses might cover topics that are censored or considered illegal by non-Canadian governments. This may include, but is not limited to, human rights, representative government, defamation, obscenity, gender or sexuality, and historical or current geopolitical controversies. If you are a student living abroad, you will be subject to the laws of your local jurisdiction, and your local authorities might limit your access to course material or take punitive action against you. UBC is strongly committed to academic freedom, but has no control over foreign authorities (please visit <http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,33,86,0> for an articulation of the values of the University conveyed in the Senate Statement on Academic Freedom). Thus, we recognize that students will have legitimate reason to exercise caution in studying certain subjects. If you have concerns regarding your personal situation, consider postponing taking a course with manifest risks, until you are back on campus or reach out to your academic advisor to find substitute courses.

For further information and support, please visit: <https://academic.ubc.ca/supportresources/freedom-expression>.