

The University of British Columbia
School of Kinesiology

**Kinesiology 313
2021 – Term 1**

Neuromuscular Integration of Human Movement

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Location and Time:

1. Professor TUTORIAL/OFFICE HOURS: Tues/Thurs 10:00-10:45 am. Canvas - Online
2. Teaching Assistant Tutorial times: To be announced on Canvas.

Summary

This course will examine the neurophysiological processes and functional neuroanatomical components involved in the sensory and motor control of movement in the Human. Emphasis is placed on a critical analysis of the literature. Topics discussed will include how the muscle functions to generate movement (i.e. control of the “motor unit”), the neural processing and sensory “coding” demonstrated by peripheral receptors, the integration at the spinal cord via reflexes, up to sensorimotor functions at the level of the brainstem and brain. Wherever possible, clinical examples of neurological disorders, such as Post Polio Syndrome, Spinal Cord injury, Stroke, Multiple Sclerosis, and other conditions that affect human movement control, will be discussed.

Global Learning Objectives

1. To explore the basic neurophysiological processes underlying the control of muscle activation, somatosensory receptors, spinal reflexes, Kinesthesia on Human movement.
2. To explore the functional roles of the various peripheral and central nervous system (CNS) structures that are known to be involved in Human motor control.
3. To examine the impairment of motor control resulting from the various lesions and clinical pathologies of the CNS.

Course Learning Objectives:

By the end of this course, you will be expected to:

- 1) **Think critically about the neurophysiological processes as they pertain to the control of human movement.**
- 2) **Be able to discuss critically the current scientific literature that uses neurophysiological techniques discussed within the lectures.**
- 3) **Demonstrate a professional behaviour within the tutorial and office hour setting, and toward class participation and involvement.**

Prerequisites: 3rd year standing or permission of the instructor.

COURSE CONTENT:

NOTE 1: lectures & online method of sharing knowledge: All the lecture-based material is pre-recorded into small modules for each lecture, and posted ahead of the date for the material to be discussed in OFFICE HOUR/TUTORIAL. Each module will be approximately 15-30 minutes long, and will be posted 24 hours in advance. **NOTE: These were recorded last year (2020) so please disregard any dates/announcements made in the pre-recorded lectures, as they apply to last year.** OFFICE HOUR/TUTORIAL times with the Professor that are based on the previously posted lecture will occur during the normal class meeting time slots (10-10:45 am, PST, Tues/Thurs in Canvas). Attendance in the OFFICE HOUR/TUTORIAL session with the Professor is not required, but it is a chance for the students to ask for clarification on the previously recorded lecture content. Question/answer sessions will also be recorded and posted after each OFFICE HOUR/TUTORIAL.

NOTE 2: Extra tutorial time: Extra meeting (tutorial) times with the Teaching assistants will be setup once the term begins. Students will be required to sign up for these tutorial slots in advance of the meetings.

I. Outline of Pre-recorded Lectured Topics

- A. **Muscles and Motor Units: The “Things” that do the moving.**
 - Control of Muscle: Motor units, recruitment, fatigue, Gender?
 - Concepts of Motor task and set.
- B. **Somatosensory Receptors: The source of “the Code”.**
 - The muscle spindle: I. Coding muscle length and velocity.
 - II. Gamma motoneurons and the muscle spindle.
 - The Hoffmann reflex and Tendon Reflex
 - Golgi tendon organs: coding muscle force
 - Joint receptors: joint position?
 - Cutaneous information - a changing role for skin?
 - Proprioception and kinaesthesia
- C. **Spinal Cord Neurophysiology: The lower loops that bind us.**
 - Spinal circuits and connections: The neural “freeway”?
 - The stretch reflex: reflexes and movement.
 - The Hoffmann and Tendon Reflexes.
 - Altered reflexes and ‘Tone’. Spasticity and Rigidity.
 - Long Latency Reflexes.
 - Central Pattern Generators and locomotion.
 - Complex Reflexive control.
- D. **Sensorimotor integration**
 - The Vestibular system. VOR, Galvanic Vestibular Stimulation (GVS).
 - what determines final motoneuron activation?

Course Evaluation

1. Midterm Lecture Examinations (50%). *Written during class time (9:30 - 10:45 am PST) online*

1. **Midterm #1: Oct. 14th, 2021** (worth 25% of overall mark in course).
2. **Midterm #2: Nov. 9th, 2021.** (worth 25% of overall mark in course).

NOTE: *If the student is unable to write (due to illness or absence, for any reason) or chooses not to write a midterm, then that missing midterm value will be added to the **final examination**. However, If the student elects to write both midterm examinations, they will be given the option of dropping **ONE** midterm grade, such that the final exam is worth 75% of the students final overall grade. **This choice has to be made by sending the course instructor an email PRIOR to writing the final examination, by no later than Dec. 9th, 2021 at 4:00 pm (PST).***

2. Final Examination (50%, 75% or 100%)

Date: The date and time of the final exam will be set by the registrar during the final exam period in December, Dec. 11th – 22nd, 2021.

NOTE: *All students are **required** to write the final examination.* The final examination is cumulative.

****Refer to UBC calendar for policy and definitions of misconduct and plagiarism.**

Notes and Readings:

- A. For each lecture there will be scanned reading material to accompany the modules covered in the lecture. These can be downloaded as PDF's that will be posted on UBC Canvas webpage dedicated to KIN 313.
- B. All lecture slides will be posted in PDF and Powerpoint format and any extra literature (scientific article readings (PDF)) assigned during the term will be likewise posted on UBC Canvas webpage for KIN 313.

Suggested readings that are provided for each lecture arise from primarily three textbooks.

- 1) Neuromechanics of Human Movement (4th edition), Roger M. Enoka (published by Human Kinetics, 2008).
- 2) Principles of Neural Science (5th edition), Kandel, Schwartz, Jessell, Siegelbaum and Hudspeth (published by McGraw Hill, 2013).
- 3) Control of Human Voluntary Movement (2nd, edition), John Rothwell (published by Chapman & Hall, 1994).

TIMETABLE & DATES of OFFICE HOURS/TUTORIALS/EXAMS

Section	Date	MEETING
A.	Tues. Sept. 7th	Class cancelled - "IMAGINE"
	Thurs. Sept. 9th	Outline/Course Introduction.
	Tues. Sept. 14th	Motor Units: Morphology
	Thurs. Sept. 16th	Motor Units: Recruitment.
	Tues. Sept. 21st	Motor Units: Current research
	Thurs. Sept. 23rd	Motor Units: Current research
	Tues. Sept. 28th	Motor Units: Summary /Graded potentials/synapse.
B.	Thurs. Sept. 30th	<u><i>Tutorial Cancelled: National Day for Truth and Reconciliation</i></u>
	Tues. Oct. 5th	The Muscle Spindle I: Afferents
	Thurs. Oct. 7th	The Muscle Spindle II: Efferent!
	Tues. Oct 12th	The Muscle Spindle summary
	Thurs. Oct. 14th	<u><i>Midterm Examination #1</i></u>
	Tues. Oct. 19th	Golgi Tendon Organs
	Thurs. Oct. 21st	Joint Receptors
	Tues. Oct. 26th	Cutaneous Receptors.
	Thurs. Oct. 28th	kinesthesia & Proprioception #1
	Tues. Nov. 2nd	kinesthesia & Proprioception #2
	Thurs. Nov. 4th	kinesthesia & Proprioception #2
Tues. Nov. 9th	<u><i>Midterm Examination #2</i></u>	
C.	Tues. Nov. 16th	Reflexes I: Basic loops
	Thurs. Nov. 18th	Reflexes II: H and T Reflexes
	Tues. Nov. 23th	Reflexes III: Intermediate loops
	Thurs Nov. 25th	Reflexes IV: Complex loops
	Tues Nov. 30th	Reflexes V: Current research
	Thurs Dec. 2nd	The Vestibular System I
Tues Dec. 7th	The Vestibular System II	

UBC ADVISORY NOTE: 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: <http://academic.ubc.ca/support-resources/freedom-expression>