

The University of British Columbia
School of Kinesiology

**Kinesiology 313 (Formerly KIN 389)
2020 – Term 1**

Neuromuscular Integration of Human Movement

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Location and Time:

1. Lectures: Tues/Thurs., 9:30-10:50 am. Online
2. Tutorial times: To be announced during class.

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 (ie. 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 lecture setting, and toward class participation and involvement.**

Prerequisites: 3rd year standing or permission of the instructor (Have not previously taken KIN 389).

NOTE 1: RE: lectures & online method of sharing knowledge: All the lecture-based material will be pre-recorded into small modules for each lecture. Each module will be approximately 10-20 minutes long, and will be posted 24 hours in advance. Each lecture will occur during the normal class meeting time slots, and consist of 3-4 modules being presented. After each module is presented, there will be up to 5 minutes of interactive time with the course instructor to answer any questions from the class before moving onto the next module. Question/answer sessions will also be recorded and posted after each lecture. Students are not required to “attend” the virtual lecture time, but may benefit from being able to ask questions of the instructor during each lecture time.

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

I. Lecture Based Sessions – Lectures Tues/Thurs 9:30 – 10:50 pm.

Outline of 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, Vestibulocollic and Vestibulospinal reflexes.
 - what determines final motoneuron activation?

Course Evaluation

1. Midterm Lecture Examinations (50%). **NOTE:**Written during class time online

Dates:

1. **Oct. 13th, 2020** (worth **25%** of overall mark in course).
2. **Nov. 5th, 2020.** (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 the 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. 4th, 2020 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. 7th – 22nd, 2020.

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

Section	Date	Lecture
A.	Tues. Sept. 8th	Class cancelled - "IMAGINE"
	Thurs. Sept. 10th	Outline/Motor Units: Morphology
	Tues. Sept. 15th	Motor Units: Recruitment.
	Thurs. Sept. 17th	Motor Units: Current research
	Tues. Sept. 22nd	Motor Units: Current research
	Thurs. Sept. 24th	Motor Units/Muscle: Summary
B.	Tues. Sept. 29th	Graded potentials/synapse.
	Thurs. Oct. 1st	The Muscle Spindle I: Afferents
	Tues. Oct 6th	The Muscle Spindle II: Efferent!
	Thurs. Oct. 8th	The Muscle Spindle summary
	Tues. Oct. 13th	<u>Midterm Examination #1</u>
	Thurs. Oct. 15th	Golgi Tendon Organs
	Tues. Oct. 20th	Joint Receptors
	Thurs. Oct. 22nd	Cutaneous Receptors.
	Tues. Oct. 27th	kinesthesia & Proprioception #1
	Thurs. Oct. 29th	kinesthesia & Proprioception #2
	Tues. Nov. 3rd	kinesthesia & Proprioception #2
C.	Thurs. Nov. 5th	<u>Midterm Examination #2</u>
	Tues. Nov. 10th,	Reflexes I: Basic loops
	Thurs. Nov. 12th	Reflexes II: H and T Reflexes
	Tues. Nov. 17th	Reflexes III: Intermediate loops
	Thurs Nov. 19th	Reflexes IV: Complex loops
	Tues Nov. 24th	Reflexes V: Current research
	Thurs Nov. 26th	The Vestibular System I
	Tues Dec. 1st	The Vestibular System II
Thurs Dec. 3rd	Course summary.	

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>