



# HK\*4070 Clinical Biomechanics

Winter 2019

Section(s): C01

Department of Human Health and Nutritional Sciences

Credit Weight: 0.50

Version 2.00 - January 08, 2019

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## 1 Course Details

### 1.1 Calendar Description

This course covers functional anatomy, neurophysiology and mechanical characteristics of humans at the tissues and whole-body levels. Pathomechanics of human movement resultant from disease, abuse or trauma will be examined. Special emphasis will be placed on etiology, testing and correction of functional disorders with special reference to balance, gait and orthopaedic biomechanics.

**Pre-Requisite(s):** ENGG\*2660 or (HK\*2270, HK\*3600)

### 1.2 Course Description

This course is designed to explore the theoretical basis of clinical biomechanics and expose students to the skills necessary to work in the area. Special emphasis will be in the areas of: Posture and Balance, Gait, and Orthopedic Biomechanics. Lectures will cover the theory underlying normal musculoskeletal system function using physics and engineering concepts. Clinical and pathological examples will be discussed to highlight differences from the healthy state, and explore how these differences arise.

**Note:** The prerequisites of HK\*2270 and HK\*3600 may be waived for Biological/Biomedical Engineering students at the discretion of the course instructor.

### 1.3 Timetable

- Lectures: Tuesday/Thursday 1:00 PM - 2:20 PM MCLN, Room 107
- Labs; as needed
  - Section 101 Monday 10:30 AM - 12:20 PM JTP 208B
  - Section 102 Wednesday 10:30 AM - 12:20 PM JTP 208B
  - Section 103 Thursday 2:30 PM - 4:20 PM JTP 208B

## 1.4 Final Exam

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

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## 2 Instructional Support

### 2.1 Instructional Support Team

**Instructor:** Dr. Lori Ann Vallis  
**Email:** lvallis@uoguelph.ca  
**Telephone:** +1-519-824-4120 x54589  
**Office:** ANNU 343  
**Office Hours:** Tuesday @ 10 am - 12 pm or by appointment

Teaching Assistants: Emily McIntosh (emcint03@uoguelph.ca) and Emily Smith (esmith20@uoguelph.ca)

TAs will be available to answer questions about Critical Reviews and Group Projects in the scheduled Tutorial Time periods. Outside this time period they may be available to meet with you by appointment; please email them to coordinate a mutually suitable time.

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## 3 Learning Resources

### 3.1 Required Resource(s)

#### Lecture Notes (Notes)

Lecture notes are the required reading for the course.

#### Lecture Slides (Notes)

Selected summary slides from the lectures will be posted on Courselink <http://courselink.uoguelph.ca> at the END of each WEEK (~ Friday evenings).

#### Journal Articles (Article)

We will be focusing on Critical Reading skills this term. To improve critical reading and writing skills we will work with professional staff from the University of Guelph library to learn search techniques and writing skills for performing critical reviews of scientific literature.

### 3.2 Additional Resource(s)

**Anatomy, Biomechanics and Control (Textbook)**

- Winter, D.A. A.B.C. (Anatomy, Biomechanics and Control) of Balance During Standing and Walking. Waterloo Biomechanics, 1995. May be helpful as a reference on occasion.

### **Clinically Oriented Anatomy (Textbook)**

- Moore, K.L. and Dalley, A.F. Clinically oriented anatomy (5<sup>th</sup> edition). Lippincott Williams and Wilkins, 2006. May be helpful as a reference on occasion.

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## **4 Learning Outcomes**

### **4.1 Course Learning Outcomes**

By the end of this course, you should be able to:

1. By the end of this course you will have,
  1. Gained increased knowledge about the role of the *sensory systems* in balance and mobility control.
  2. Gained increased knowledge about the impact of *different health conditions and pathologies* on balance and mobility.
  3. Gained experience with performing *critical reviews of published scientific findings*.
  4. Gained *knowledge and practice performing different clinical tests* designed for the assessment of posture and mobility at different stages of lifespan development and/or for different health conditions.
  5. Obtained a brief *hands on training experience* performing a small research study in a science laboratory OR through a community based group experiential learning project involving a clinician and a member of a clinical population.
  6. Gain *project management experience* and gain skills to manage and navigate *group dynamics* over the course of conducting the experiential learning activity.
  7. Gain greater understanding and experience with *preparing a manuscript or clinical case report* using the scientific method.

## 5 Teaching and Learning Activities

### 5.1 Summary of Laboratories

Labs will not be held each week. Rather we will use laboratory time throughout the course to:

- Gain hands on experience with reviewing clinical tests that will be useful in the group project
- Gain hands on experience with biomechanics instrumentation that will be used in the group project. Students will meet with TAs to review data collection, analysis and reduction techniques and the interpretation of acquired data.
- Meet with Teaching Assistants (TAs) to discuss the clinical group project milestones and challenges, e.g. preparation of the Project Proposal, Oral presentation and final Written group project report.

### 5.2 Clinical Case Report

The small-group case report represents a large evaluation component of the course. Students are asked to get into groups of 4 to 5 individuals (no groups will be allowed to be larger or smaller than this). If at all possible, you should be with people who are in the same HK\*4070 laboratory section.

**There are two options for this report:**

1. **Replicate a published research study.** Suggested topics include balance or gait. The purpose of this project format is to provide a hands-on laboratory experience tailored to the interests of the group. Group members must pick a research study to replicate that must be, 1) based within Clinical Biomechanics, 2) must involve collecting and analyzing data, and 3) must use available equipment and software found in JTP 208B (i.e. force plate, LabView software). Your Project Proposal is due to the course instructor by Tuesday February 5, 2019 and is worth 5%; it will include the names and signatures of each group member, citation for the published paper to be replicated, a list of required equipment and a general timeline/plan for your lab data collection, analyses and write up. Your group will play the role of a Research Assistant being hired by a Professor at a University to conduct a small pilot research project involving ~3-4 participants. The final report is in the form of a manuscript based on the data collected for the group project. It will be similar to the article that you are replicating, but not necessarily the *exact* same focus. It should include additional current, pertinent references, and the discussion should be tailored to

your particular project and interests.

2. **Community-based clinical assessment.** You will be expected to go out into the Guelph area and find a setting that is willing to let your group come into their environment and perform a clinical assessment, similar to what we will be learning about in lectures. Your Project Proposal is due to the course instructor by Tuesday February 5, 2019 and is worth 5%; it will include the names and signatures of each group member, the name and contact for your Clinical Case partner, and an outline of the clinical case you will study (brief literature review, clinical tests you hope to observe/perform) to ensure it is appropriate for the project. Try to find a community partner, which has welcomed student volunteers from the University of Guelph in the past, or businesses where Kinesiologists, Occupational Therapists or Physiotherapists are on staff and are willing to work with your group as a practical training exercise. This may include the following organizations in Guelph:

1. St. Joseph's Health Center (older adults, individuals recovering from Stroke, traumatic brain injuries)
2. KidsAbility (children with special needs, e.g. Cerebral Palsy, Down's Syndrome, Autism spectrum)
3. Kids Therapy Network Associates (occupational therapy assessment, treatment and consultation)
4. Guelph Community Health center (health programs & services to improve health and well-being)
5. Custom Orthotic Design (design, fabrication and fitting of orthoses intended to prevent or correct deformities; redistribute forces evenly; improve the function of a weakened extremity.)

- Your group will play the role of a Kinesiologist being hired by a company to perform a clinical biomechanics assessment of posture, balance, gait and/or mobility. Each group will submit one "Clinical Case Study Report" to summarize their findings. This report is expected to be professional and it is mandatory that a second hard copy be submitted to the community organization you worked with. The students must ADDITIONALLY submit an electronic copy of their final report to the professor.
- Students are encouraged to use any of the assessment tools discussed in this course to strengthen their report. In addition, the group will present their project in lecture during Week 12 (March 26, or 28, 2019).
- Note: everyone in a group will normally receive the same mark for the project. However, the instructor reserves the right to assign a higher or lower mark to

individuals who have done much more or much less than their share of the allotted work, by consensus of their group.

- Report Format: Please follow the format outlined for traditional Case Report in the journal *Physical Therapy*.

[https://academic.oup.com/ptj/pages/Author\\_Guidelines#What%20is%20Your%20Article%20Type](https://academic.oup.com/ptj/pages/Author_Guidelines#What%20is%20Your%20Article%20Type)

**Abstract.** Structure: Background and Purpose, Case Description, Outcomes, Discussion  
**Body of Manuscript.** Word limit: 2,000 words (excluding abstract and references). The journal recommends that authors use tables whenever possible to provide important details (history, examination, intervention, and outcome information for clinical case reports; program elements and materials for educational/administrative case reports); please consider this recommendation for your HK\*4070 Case Report.

**References.** No more than 20

- Sample case reports can be found on the journal website as well as on the course D2L site.

### 5.3 Class Schedule

Material presented in class and laboratories may vary slightly from that depicted here.

Week	Lecture Topics	Laboratory
Jan 8-10	Week 1: <ul style="list-style-type: none"> <li>• Introduction; Project Organization</li> <li>• <i>Biomechanics review</i>: Kinetics, kinematics; anatomy review. <i>Focus on posture &amp; locomotion</i></li> <li>• Center of pressure, center of gravity and center of mass; Strategies for maintaining postural control</li> </ul>	NO LABS THIS WEEK
Jan 15-17	Week 2: <ul style="list-style-type: none"> <li>• Common perturbations to posture &amp; locomotion</li> <li>• Guest Lecture: Janie Vu, Experiential</li> </ul>	

Learning, Professionalism and Learning  
Reflections

Jan 22-24	Week 3:	Clinical Balance Assessment  (JTP 208B)
	<ul style="list-style-type: none"> <li>• Sensory contributions to balance</li> <li>• Kinematic data smoothing techniques</li> </ul>	
Jan 29-31	Week 4:	
	<ul style="list-style-type: none"> <li>• Initiation of gait &amp; Termination of gait</li> <li>• Development &amp; postural control</li> </ul>	
Feb 5-7	Week 5:	
	<ul style="list-style-type: none"> <li>• Degeneration &amp; postural control</li> <li>• Pathological differences in balance</li> </ul>	
Feb 12-14	Week 6:	
	<ul style="list-style-type: none"> <li>• Balance Control Case Studies</li> </ul>	
Feb 19-21	Week 7:	No Labs - Reading week
	<ul style="list-style-type: none"> <li>• No class - Reading week</li> </ul>	
Feb 26-28	Week 8:	
	<ul style="list-style-type: none"> <li>• Overview: Biomechanics of Gait</li> <li>• Sensory contributions to gait: Proprioception</li> </ul>	
March 5-7	Week 9:	Clinical Gait Assessment  (JTP 208B)
	<ul style="list-style-type: none"> <li>• Gait: Case study w. ACL injury</li> </ul>	

March 12-14 Week 10:

- Navigation during gait: Role of Sensory Input
- Sensory contributions to gait: Visual and Vestibular deficits

March 19-21 Week 11:

- Development & Locomotion
- Degeneration & Locomotion

March 26-28 Week 12:

NO LABS THIS WEEK

- Small-Group Presentations (in lecture)

April 2-4 Week 13:

NO LABS THIS WEEK

- Locomotion in special populations
- Case Studies & Review
- Case reports due Thurs April 4

## 5.4 Note

Friday March 8th is the last day to drop a class

Final Exam: TBA

# 6 Assessments

## 6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Critical Review #1: Focus on Research Question (Learning outcomes #1,2,3)	8
Critical Review #2: Focus on Methodology (Learning outcomes #1,2,3)	10
Critical Review #3: Focus on Full Report (Learning outcomes #1,2,3)	12

Name	Scheme A (%)
Clinical Case - Proposal (Learning outcomes # 4,5,6)	5
Clinical Case - Group Oral Presentation (Learning outcomes #1-6)	10
Clinical Case - Written Report (Learning outcomes #1-6)	15
Final Examination (Learning outcomes #1,2,3,4)	40
Total	100

## 6.2 Assessment Details

### Critical Review #1: Focus on Research Question (8%)

Due: Tue, Jan 29

### Critical Review #2: Focus on Methodology (10%)

Date: Thu, Feb 14

### Critical Review #3: Focus on Full Report (12%)

Date: Tue, Mar 12

### Clinical Case - Proposal (5%)

Due: Tue, Feb 5

### Clinical Case - Group Oral Presentation (10%)

Date: March 26 or 28, In lecture

### Clinical Case - Written Report (15%)

Due: Thu, Apr 4

### Final Examination (40%)

Exam Date: To Be Announced

## 7 Course Statements

### 7.1 Course Rule

Please inform the instructors of potential time conflicts with scheduled evaluations by **Tuesday January 17, 2019**. If any scheduled evaluations are missed due to documented illness or compassionate circumstances, you must inform an instructor within 5 days of the missed evaluation. Negligence to do so may result in failure of the missed component. Accommodations following these circumstances will be made at the discretion of the course instructor. If a student has any objections or concerns regarding the way a quiz or examination has been graded, they may resubmit their quiz/exam paper for re-marking; the risk, however, is that this re-evaluation will remain the final one, whether higher or lower in score than the original.

### 7.2 Grading

Indicate all course policies regarding in-semester tests and assignment submissions, including time and place for submission of assignments and explicit penalties for late submissions.

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## 8 Department of Human Health and Nutritional Sciences Statements

### 8.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

### 8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. <http://www.learningcommons.uoguelph.ca/>
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: <http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help> and <http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help>

### 8.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. <https://www.uoguelph.ca/counselling/>
- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations.

<http://www.uoguelph.ca/~ksomers/>

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## 9 University Statements

### 9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

### 9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

### 9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for course registration are available in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

### 9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### 9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

More information can be found on the SAS website  
<https://www.uoguelph.ca/sas>

## 9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community—faculty, staff, and students—to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct  
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma

programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

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