1 Course Details

1.1 Calendar Description

This course presents an overview of bone and joint function from a biomechanics perspective, within the framework of health and injury. Particular emphasis is placed on the influence of biomechanical signals on the regulation of bone and joint structure and function. Individual diseases, such as osteoarthritis, will be considered as they impact the various tissues of the joint (cartilage, ligament and bone) and the neuromuscular system. The laboratory will provide supplementary material illustrating particular aspects of musculoskeletal function including in vivo and in vitro biomechanical testing.

Pre-Requisite(s): ENGG*3150 or HK*2270

1.2 Course Description

This course presents an overview of neuromuscular tissue function in health, injury and disease from a biomechanics perspective. Particular emphasis is placed on understanding and applying biomechanical principles to the characterization of soft tissue, bone and joint structure and function, in health and injury. The impact of individual diseases, such as osteoarthritis and osteoporosis, will be studied in the context of their impact on the various tissues (cartilage, ligament, muscle and bone) comprising the neuromuscular system. Clinical applications of these biomechanical principles will be emphasized in the second half of the course to address the diagnosis, assessment, treatment and clinical management of conditions affecting the neuromuscular system, in health and disease. The laboratory component will expose the student to practical and clinical skills relevant to the assessment of the neuromuscular system, interpretation of clinical tests and formulation of clinical impression/diagnosis in the physical assessment of the patient in health and disease.

1.3 Timetable

Lectures: Monday, Wednesday, Friday from 10:30am-11:20am. Lectures are held at Rozanski Hall 102

Labs: Monday, Wednesday and Friday, 12:30-2:20pm and Wednesday, 2:30-4:20pm. A total of three (3) labs will be conducted at a time to be announced. Labs will be held in JTP 215
1.4 Final Exam

Final Examination for Fall 2018 Semester is scheduled for Monday December 3, 2018 from 8:30am-10:30am. Room TBA.

2 Instructional Support

2.1 Instructor(s)

John Srbely DC PhD
Email: jsrbely@uoguelph.ca
Telephone: +1-519-824-4120 x52058
Office: HHNS Annex 281
Office Hours: By appointment

2.2 Teaching Assistant(s)

Teaching Assistant: Felipe Coutinho Kullmann Duarte
Email: coutinhf@uoguelph.ca
Office Hours: By appointment. Please contact by email to schedule an appointment.

Teaching Assistant: Lukas Linde
Email: llinde@uoguelph.ca
Office Hours: By appointment. Please contact by email to schedule an appointment.

Teaching Assistant: Emma Plater
Email: platere@uoguelph.ca
Office Hours: By Appointment. Please contact by email to schedule an appointment.

3 Learning Resources

There is no required textbook for this course.

3.1 Required Resource(s)

CourseLink (website) (Website)
All course material, news, announcements, online quizzes and grades will be administered and/or regularly updated on the HK*4610 CourseLink site.

Study materials including lecture and lab notes, and supplementary readings will be added to the site on an ongoing basis.

You are responsible for checking the site regularly to keep up to date on all course activities.
4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Characterize mechanisms of tissue injury in bone, tendon, ligament, cartilage and muscle tissues using basic principles of biomechanics, tissue and fluid mechanics.
2. Learn to perform a clinical history and orthopedic/neurologic physical examination/assessment.
3. Interpret the findings of a clinical history and physical examination to confer a clinical opinion/impression/diagnosis.
4. Learn how to communicate clinical findings with other health professionals, including how to record SOAP notes.
5. Understand the key clinical features of musculoskeletal injuries and disease, and applying these to clinical assessment and diagnosis of a patient.
6. Understand physiologic mechanisms of acute and chronic pain and how to clinically assess patients with chronic pain.
7. Understand and apply principles of evidence-based rehabilitation and injury management principles to the clinical management of musculoskeletal injury and disease.
8. Appreciate and understand the role and contribution of the Certified Kinesiologist in the Canadian health delivery system

5 Teaching and Learning Activities

Course topics

- Clinical Biomechanics review
- Tissue mechanics, structure and function of:
  - bone
  - tendon
  - ligament
  - cartilage
  - muscle
  - joints
- injury and healing
- clinical epidemiology
- acute and chronic pain
- injury prevention
• clinical applications of biomechanics
  ◦ diagnosis and assessment of injury
  ◦ management of musculoskeletal injury and disease

5.1 Lecture

Week 1

Topic(s): Lecture 1-REVIEW OF BIOMECHANICAL PRINCIPLES RELEVANT TO THE STUDY OF INJURY

Kinetics v Kinematics


Forces and Moments: Muscle force and joint moments, Clinical applications including: Coxa vara, coxa valga, Low back pain, Q-angle, Rotator cuff strain, Joint Stability, Stabilizing vs destabilizing joint forces and their role in injury

Week 2

Topic(s): Lecture 2-CONNECTIVE TISSUES, HEALING AND TISSUE REPAIR, PRINCIPLES OF REHABILITATION

Histology and classification of connective tissue, Collagen Types, Mechanical properties.
Comparison of connective tissues including:

1. Tendon and ligament,
2. Cartilage
3. Bone

Inflammation

Tissue Repair and regeneration

1. Tissue remodeling
2. RICE
3. Therapeutic modalities and their role in injury management

Therapeutic Exercise Programming

Week 3

Topic(s): Lecture 3-MATERIAL MECHANICS AND VISCOELASTIC TISSUES

Structural v material properties of tissues: Stress-strain, Load-deformation

Bending moment of inertia and impact on injury

Tissue loading

Biomechanical principles of injury and tissue failure
Properties of viscoelastic tissues and how they relate to injury

1. Stress-relaxation
2. Creep

**Week 4**
**Topic(s):** Lecture 4-TISSUE MECHANICS-BONE
Bone development and related injury considerations

1. Peak height velocity (PHV)
2. Bone mineral density (BMD)
3. Bone strength
4. Stress-strain properties of bone
5. Effect of bone mineralization and collagen
6. Bone Density
7. Porosity and Mineralization

Effect of clinical conditions on bone strength and material properties

1. Osteoporosis
2. Osteoclastic bone disease (cancer, metabolic)

Determinants of bone strength and how to optimize this through therapeutics and lifestyle management

Bone adaptation and remodeling: Therapeutic implications, Vibration, Exercise, Medication and pharmacotherapeutics, Nutrition and prevention

Bone injury

**Week 5**
**Topic(s):** Lecture 4-TISSUE MECHANICS-CARTILAGE
Cartilage structure and function: Cartilage matrix structure, Cartilage mechanics, Cartilage growth and repair, Cartilage adaptation and aging

1. Clinical implications: Cartilage injury, Disc injury/pathology, Meniscus, Arthritis
2. Prevention of cartilage injury and degeneration

Therapeutics

Cartilage structure and function: Cartilage matrix structure, Cartilage mechanics, Cartilage growth and repair, Cartilage adaptation and aging

Clinical implications: Cartilage injury, Disc injury/pathology, Meniscus, Arthritis

Prevention of cartilage injury and degeneration

Therapeutic management of cartilage injury and disease
Week 6
Topic(s): Lecture 6-TISSUE MECHANICS-TENDON AND LIGAMENT
Structure of ligaments and tendons: Anisotropy and clinical implications

Tendon injury

Ligament injury

Structural Properties of tendon/ligament: Stress-strain, Cross-sectional area, Length

Factors influencing mechanical properties of tendon and ligament: Exercise, Tension, Age, Use v Disuse, Therapeutic implications

Biomechanical principles relevant to muscle injury: Anatomy, Muscle architecture, Fusiform v penniform, Force-length, Force-velocity, Power-velocity, Efficiency of muscle contraction

Muscle Injury: Strain, Sprain, Contusion, Muscle cramp, DOMS

Pathophysiology and Clinical Considerations for nerve injury: Peripheral nerve, Central Nervous System

Week 7
Topic(s): Lecture 7-CLINICAL HISTORY TAKING AND PATIENT ASSESSMENT
How to perform a thorough clinical history and physical examination

Legal and Ethical Considerations of Patient Assessment and Management

Posture Assessment: Techniques, Types of curvatures

Cranial Nerve Examination

Week 8
Topic(s): Lecture 8-PAIN AND INFLAMMATION
Classification of pain: Definition, Models and dimensions of pain, Pain vs nociception, Referred pain

Inflammation: chronic vs acute

Cardinal/clinical signs of inflammation

Management of Inflammation and Pain: Phases of healing, RICE

Central sensitization: mechanisms and clinical manifestation

Pain Management: Clinical evaluation, Pain assessment techniques

Therapeutic options for pain management

Pain and aging

Pain and Disability: Disability vs impairment
Lecture 11 - CLINICAL CONSIDERATIONS AND INJURY MANAGEMENT OF THE SPINE

**Topic(s):**

Functional Anatomy-Spine:

- Kinematics and Kinetics
- Anatomy of the Spine

Injury Prevention in everyday activities

Assessing spinal posture: Spinal curvatures that predispose to injury

Definition, mechanism of injury, signs and symptoms and management:

- Whiplash, Sprain and strain, Suboccipital region,

Clinical implications: Cervicogenic headache, Disequilibrium and vertigo

Low Back Pain: Acute low back pain, Chronic low back pain, Mechanical vs discogenic low back pain

Spinal stenosis

Dowager’s Hump

Degenerative Disc Disease: Pathophysiologic mechanisms, Disc loading and it’s contribution to DDD, Stages of discopathy

Sciatica and herniated disc:

Spondyloysis and spondylolisthesis

Arthritis

Osteoarthritis: Primary vs secondary, Diagnostic criteria of OA, Radiographic, Clinical

Seropositive Arthritis: Rheumatoid Arthritis

Seronegative Arthritis: Ankylosing Spondylitis: Enteropathic, Psoriatic

**Wed, Sep 5 - Sat, Dec 1**

**Topic(s):**

Tentative Lecture Schedule Fall 2018

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Room</th>
<th>Lecture Topic</th>
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<tbody>
<tr>
<td>September 7</td>
<td>10:30-11:30 am ROZ 102</td>
<td>Introduction</td>
<td></td>
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<tr>
<td>September 10</td>
<td>10:30-11:30 am ROZ 102</td>
<td>Review of Clinical Applications of Biomechanics</td>
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<tr>
<td>September 12</td>
<td>10:30-11:30 am ROZ 102</td>
<td>Classification of Biological Tissues</td>
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<tr>
<td>September 14</td>
<td>10:30-11:30 am ROZ 102</td>
<td>Clinical Biomechanics and Energy</td>
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<tr>
<td>September 17</td>
<td>10:30-11:30 am ROZ 102</td>
<td>Clinical Biomechanics and Energy</td>
<td></td>
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<tr>
<td>September 19</td>
<td>10:30-11:30 am ROZ 102</td>
<td>Joint Mechanics</td>
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<tr>
<td>September 21</td>
<td>10:30-11:30 am ROZ 102</td>
<td>Material Mechanics</td>
<td></td>
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</tbody>
</table>
September 24 10:30-11:30 am ROZ 102 Viscoelastic Tissues
September 26 10:30-11:30 am ROZ 102 Tissue Loading
September 28 10:30-11:30 am ROZ 102 Bone Structure and Formation
October 1 10:30-11:30 am ROZ 102 Bone Structure and Formation
October 3 10:30-11:30 am ROZ 102 Biomechanics of Bone
October 5 10:30-11:30 am ROZ 102 Bone Adaptation and Remodeling
October 8 THANKSGIVING
October 10 10:30-11:30 am ROZ 102 Ligament and Tendon Structure
October 12 10:30-11:30 am ROZ 102 Ligament and Tendon Biomechanics
October 15 10:30-11:30 am ROZ 102 Cartilage
October 17 10:30-11:30 am ROZ 102 Cartilage
October 19 10:30-11:30 am ROZ 102 MID TERM EXAM
October 22 10:30-11:30 am ROZ 102 Clinical History Taking
October 24 10:30-11:30 am ROZ 102 Posture
October 26 10:30-11:30 am ROZ 102 Posture
October 29 10:30-11:30 am ROZ 102 Inflammation and Tissue Healing
October 31 10:30-11:30 am ROZ 102 Pain
November 2 10:30-11:30 am ROZ 102 Pain
November 5 10:30-11:30 am ROZ 102 Guest Lecture: Ortho Physical Assessment of Shoulder (Long)
November 7 10:30-11:30 am ROZ 102 Upper Extremity
November 9 10:30-11:30 am ROZ 102 Upper Extremity
November 12 10:30-11:30 am ROZ 102 Lower Extremity
November 14 10:30-11:30 am ROZ 102 Lower Extremity
November 16 10:30-11:30 am ROZ 102 Head Neck and Spine
November 19 10:30-11:30 am ROZ 102 Head Neck and Spine
November 21 10:30-11:30 am ROZ 102 Head Neck and Spine
November 23 10:30-11:30 am ROZ 102 Guest Lecture: Exercise Prescription (Bucciarelli)
November 26 10:30-11:30 am ROZ 102 Guest Lecture: Exercise Prescription (Bucciarelli)
November 28 10:30-11:30 am ROZ 102 Guest Lecture: Musculoskeletal Epidemiology (Nolet)
November 30 10:30-11:30 am ROZ 102 Review Lecture

5.2 Lab

TBA

**Topic(s):** Lab 1 - Physical Examination of the Upper Limb and Cranial Nerves

**Aims of the Clinical Assessment:** History, Physical Examination

Cervical Spine: ROM - assessment of both active and passive ranges

Physical assessment of the Atlanto-Occipital Region

Testing for cervical myotomes

Special Tests for Cervical Spine: Kemps, Formalinal Compression, Cervical Distraction,
Valsalva, L'Hermitte

Thoracic Outlet Syndrome: pathophysiology and physical examination; Adson's Test

Reflex Testing: C5-C7

Assessment of the Shoulder: Glenohumeral, Acromioclavicular and Scapulothoracic Joints

1. Range of Motion
2. Apley's Scratch Test
3. Impingement Sign
4. Supraspinatus and Biceps test
5. Shoulder apprehension test

Elbow: Range of Motion, tests for ligamentous instability, Tinel's sign, strength testing

Carpal Tunnel Syndrome: diagnosis and assessment

TBA

Topic(s): Lab 2 - Physical Assessment of Spine and Lower Limb

Postural Assessment

Scoliosis: Assessment and Management

Assessment of the Lumbar Spine

1. motion palpation of the lumbar spine and pelvis
2. Lasegue's Straight Leg Raise Test
3. Deyelle-May Test
5. Reflex Testing
6. Dermatomal testing

Assessment of the Hip

1. Range of Motion
2. Compression Test

Assessment of the Knee

1. Range of Motion
2. Palpation of knee landmarks
3. Drawer Sign for ACL
4. Medial/Lateral Gap test for collaterals
5. Meniscal tests (Apley's compression, McMurray)
6. Patellar Compression for Chondromalacia Patellae

Assessment of Foot and Ankle
1. Range of Motion
2. Achilles tendon
3. Medial and lateral malleoli
4. Tarsal bones
5. Talofibular ligament
6. Deltoid ligament

Cranial Nerve Examination

TBA

**Topic(s):** Lab 3- Core: Scapular and Lumbo-Pelvic Assessment

**Assessment of Scapular Stability and Function**

1. Scapular Anatomy: muscles and ligaments
2. Scapular dyskinesis
3. Scapulo-humeral rhythm
4. Scapular repositioning tests

**Rehabilitation of "Core" Scapular Exercises**

**Impingement Syndromes**

**Lumbo-Pelvic Core**

1. Assessment of lumbar stability
2. Anatomy of the pelvis: muscle and ligament
3. Assessment of the pelvic function
4. Sorensen's Test
5. Prone double straight leg raise test
6. active straight leg raise test

**Exercise and Rehabilitation of the Low Back Pain patient**

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**6 Assessments**

**6.1 Assessment Details**

**Midterm Exam (20%)**
Date: October 19, 2018
Mid-Term will be held in the regularly scheduled lecture timeslot (ROZ102).

Learning Outcomes # 2 and 3.

**Online Quizzes (40%)**
Date: TBA
A total of 5 online quizzes will be offered. The best 4 of 5 quizzes will be used to calculate your mark (each 10%).

The dates of the online quizzes will be scheduled on a TBA basis, as material is covered in class.

Learning outcomes # 2-9.

Lab Quiz (10%)
Date: TBA
An online lab quiz will be offered for each of the first 2 labs. Each quiz is worth 5% each.

Learning Outcomes # 3, 4, 5, 6, 8

Final Exam (30%)
Date: Mon, Dec 3, 8:30 AM - 10:30 AM, TBA
Learning outcomes # 2-9

7 University Statements

7.1 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.

7.2 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 regulations and procedures for Academic Consideration are detailed in the Undergraduate Calendar.

7.3 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 Dropping Courses are available in the Undergraduate Calendar.

7.4 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.

7.5 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: www.uoguelph.ca/sas

**7.6 Academic Misconduct**

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 discourages misconduct. 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.

The [Academic Misconduct Policy](#) is detailed in the Undergraduate Calendar.

**7.7 Recording of Materials**

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

**7.8 Resources**

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.