

Faculty of Engineering
 McMaster University
 Term 2 (January – April 2022)



MECH ENG 715
Biomechanics of Injury and Prevention
 cross-listed as BIOMED 715
 (updated 07 December 2022)

Instructor: G. Wohl
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Lecture: Thursday, 2:00 PM-5:00 PM (**start Jan 13**)
Location: JHE 323
Course Web Site: via Avenue to Learn @ McMaster

Course Objectives:

- To learn concepts related to the biomechanics of acute injury and failure mechanisms with a focus on musculoskeletal and brain injuries.
- To understand the theory behind methods and devices for prevention of injuries with particular focus on motor vehicle collisions and sport-related injuries

Learning Outcomes:

At the end of this course, students will be expected to have demonstrated the ability to:

- Identify anatomical regions associated with common and/or significant mechanically induced injuries.
- Explain the implications of injury to major anatomical locations (e.g., upper extremity, lower extremity, neck, trunk, and head).
- Identify and explain concepts in energy dissipation for prevention of injuries.
- Explain approaches and limitations for engineering designs to prevent injuries in automobile collisions and/or sport related injuries.
- Perform a search of the scientific literature on a topic related to injury and prevention, and critically analyze the literature to provide a review and propose potential new research directions for the topic of research.

Lecture Content: (this lecture list is tentative and is subject to change)

1	13-Jan	Introduction – concept of injury
2	20-Jan	Impact and energy dissipation + introduction to injury prevention
		Biological tissues – structure and organization
3	27-Jan	Tissue biomechanics and adaptation
4	03-Feb	Mechanisms of injury
5	10-Feb	Lower extremity injuries
6	17-Feb	Upper extremity injuries
7	24-Feb	Neck and trunk injuries
8	02 Mar	Head / brain injuries
9	09-Mar	Models of Injury Mechanisms
		Collision Severity and “Delta-V”
10	16-Mar	Methods of injury prevention (seat belts, air bags, helmets)
	23-Mar	

Textbook(s):

There is no required textbook for the course. A reading will be assigned weekly for each topic and assigned papers will be distributed. The following is a list of some key reference materials (including McMaster library number):

- Whiting W.C., Zernicke R.F. Biomechanics of Musculoskeletal Injury. Human Kinetics [WE 140 .W613b 2008]
 Mow V.C., Huiskes R. Basic Orthopaedic Biomechanics & Mechano-Biology. Lippincott Williams Wilkins [WE 103 .B3125 2005]
 Nahum A.M., Melvin J. Accidental Injury: Biomechanics and Prevention. Springer [WO 700 .A1714 2002]

Course Structure and Evaluation:

The weekly three hour “lecture” period will be separated approximately into three sections: (see below for grading)

- 1) brief weekly quiz based on the previous week’s material [15-20 min],
- 2) discussion of injury mechanisms and critical review of literature or student presentation regarding the critical analysis of an injury mechanism [1 hr], and
- 3) instructor lecture of the new topic [1.5 hr].

Critical Analysis of an Injury Mechanism: Every student will be assigned a mock collision and injury (or injuries) that must be analyzed. The assignment is to explain the mechanism of injury as it might have occurred in the collision and to argue (using appropriate background from the scientific literature) whether or not appropriate protective measures were used by the occupant (e.g., seat belt), or if protective measures would have prevented the injuries.

Grading:

Weekly quiz	10 x 2%	20%
Assignment – literature search and in-text citation		5%
In-class participation in discussion and presentations		5%
Critical Injury Analysis		70%
• Letter of Engagement	3%	
• Injury summary – written	4%	
• Injury summary – presentation	4%	
• Injury mechanism – presentation	7%	
• Restraint analysis – presentation	7%	
• Final presentation	20%	
• Final report	25%	

Presentations and written reports will be evaluated based on rubrics (to be posted on Avenue).

All written reports are to be submitted via Avenue dropbox. All media used for presentations must also be uploaded via Avenue dropbox.

Note: An “**Originality Check**” will be employed for all dropbox submissions to measure duplication with existing documents and literature. The purpose is to encourage you to develop your own writing skills (and to discourage the practice of duplication).

You can check your own papers (or any other papers) by creating a login and enrolling at: www.turnitin.com

Class ID: **32720436**

Enrolment password: **BME715_2022**

Policy Reminders:

Students are reminded of the following Policies, which could be relevant to activities in this course.

Adverse Discrimination

“The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem that cannot be resolved by discussion among the persons concerned, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.”

Academic Integrity (Ethics and Dishonesty)

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. **the grade of zero on an assignment, loss of credit with a notation on the transcript** (notation reads: "Grade of F assigned for academic dishonesty"), **and/or suspension or expulsion from the university.**

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at: <http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf>

The following illustrates only two forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Copying or using unauthorized aids in tests and examinations.

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

STUDENT SUPPORTS

WELLNESS

Student Wellness Centre

On-Campus Support for Medical and Mental Health Concerns. Doctors and Counsellors available. Located in PGCL, 2nd Floor.

Mon-Fri 9AM-5PM 905-525-9140 ext. 27700
<https://wellness.mcmaster.ca/contact-us/>

Main St. West Urgent Care Centre

For immediate health concerns that do not require the emergency room.

690 Main St W - Mon-Sun 9AM-9PM

Emergency Rooms

For **immediate, serious** health concerns.

St. Joseph's Healthcare Hamilton
50 Charlton Ave E

McMaster Children's Hospital
Students 17 and under

Telehealth Ontario

Telehealth Ontario is a free, confidential service you can call to get health advice or information. A Registered Nurse will take your call 24 hours a day, seven days a week.

Toll-free: 1-866-797-0000 Toll-free TTY: 1-866-797-0007

Phone Lines

Good2Talk

Confidential helpline providing professional counselling, info and referrals for mental health, addiction, and well-being

1-866-925-5454

LGBT Youthline

Confidential, non-judgemental & informed LGBTQQ2SI peer support.

Sun-Fri, 4-9:30 PM, Text 647-694-4275

SACHA (SEXUAL ASSAULT CENTRE - HAMILTON AREA)

Confidential, anonymous 24-hour nonjudgmental telephone support for adults who have experienced sexual violence at any point in their lives; will provide accompaniment to hospital or police station for survivors wishing to seek medical attention or report; counselling services & public education

905-525-4162

Empower Me (Graduate Students)

24/7 accessible counselling services to empower you to thrive, crisis support, mental health and well-being services.

1-844-741-6389

Bounceback

CBT skills-building for mild to moderate depression and anxiety for people 15 or older. If accessed through self-referral, the client's primary care provider will be notified.

1-866-345-0224

INDIGENOUS STUDENTS

Indigenous Student Services

Academic & social counselling, employment aid
LRW 1010

ext. 23788

indigenous.admin@mcmaster.ca
indigenous.mcmaster.ca

INTERNATIONAL STUDENTS

International Student Services

Advising services for international students and exchange students
GH 104

ext. 24254

iss@mcmaster.ca
iss.mcmaster.ca

STUDENT SUPPORTS

ACADEMIC

Student Success Centre

Academic skills assistance, job search, volunteering
GH 110
ext. 24254
studentsuccess@mcmaster.ca

Student Accessibility Services

Disability services, assistive technology support
MUSC B107
ext. 28652
sas@mcmaster.ca

TutorOcean

Student to Student Tutoring Services
<https://mcmaster.tutorocean.com/>

FINANCIAL

Office of Student Financial aid and Scholarships

Emergency funding, government funds, OSAP assistance, scholarships, work programs
GH 120
ext. 24319
<https://registrar.mcmaster.ca/aid-awards/>

FOOD

Food Collective Centre (FKA Mac Bread Bin)

The Food Collective Centre is a service run by students dedicated to cultivating stronger food systems in the McMaster and surrounding community. (MSU Service)
macbreadbin@msu.mcmaster.ca
<https://www.msumcmaster.ca/services-directory/14-food-collective-centre>

Neighbour 2 Neighbour

Food bank, community kitchen, community counselling, help with paying for utilities, and more. Hamilton Mountain.
905-574-1334 <http://www.n2ncentre.com/>

CRISIS SUPPORT

Barrett Centre for Crisis Support

Provides a safe environment in the community and responds to the needs of individuals, 16 years of age or older, who experience a mental health crisis and do not require a hospital stay. Confidential and free services 24/7/365
24 Hour Crisis Line: 905-529-7878, Toll Free: 1-844-777-3571

COAST (Crisis Outreach and Support Team)

Hamilton's crisis line is answered 24 hours a day, 7 days a week. The COAST mobile team, consisting of a mental health worker, and a police officer, will respond to crisis calls between the hours of 8 a.m. and 1 a.m. daily.
905-972-8338

Oakville Distress Centre

Distress Centre Halton provides telephone and online support to people to better cope with crisis, loneliness, and emotional stress. Also serves the Hamilton area.
905-849-4541

Assaulted Women's Helpline

Free, anonymous and confidential telephone and TTY crisis telephone line to all women in the province of Ontario who have experienced any form of abuse. Provides crisis counselling, safety planning, emotional support, information and referrals accessible 24/7/365.
Toll-free: 1-866-863-0511 TTY: 1-866-863-7868

Crisis Resources in the GTA

The CAMH Distress Crisis Resources web page lists a number of phone lines, response teams and hospitals in the GTA.
<https://www.camh.ca/en/health-info/crisis-resources>

STUDENT SUPPORTS

OTHER

Student Assistance Plan (Undergraduate)

Psychological counseling (offered in-person, over the phone, or over secure video) and academic-life services (legal consultation, financial consultation, life coaching, nutrition consultation and wellness resources offered virtually or in-person)

<https://www.msumcmaster.ca/services-directory/36-health-and-dental-insurance/student-assistance-plan>

Ombuds Office

Advice for students, staff, and faculty regarding academic and non-academic concerns.

MUSC 210

ext. 24151

ombuds@mcmaster.ca

mcmaster.ca/ombuds

SWHAT - Walk Safe Program

The Student Walk Home Attendant Team (SWHAT) is a volunteer service within the McMaster Students Union that will walk or bus with students during the evening hours 7 days a week, in all kinds of weather! (MSU Service)

Ext. 27500

swhat@msu.mcmaster.ca

Student Support and Case Management

Student rights & responsibilities

GH 207

ext. 23845

studentconduct.mcmaster.ca

Chaplaincy Centre

Pastoral support with personal counselling and bereavement support groups.

MUSC 231

ext. 24207

McMaster Engineering Society

Support from other McMaster Engineering Students

<https://www.macengsociety.ca/>

MSU PEER SUPPORT SERVICES

MSU Maccess

Maccess is a service that aims to build and maintain a campus that celebrates, advocates, and ensures inclusivity in the area of disability. A central aspect to Maccess is the provision of peer support by trained volunteers with lived experiences with disability such as chronic illness, mental illness, mental health concerns, neurodivergence, and additional identities.

Student Health Education Centre

SHEC is a peer-run health promotion, education, and referral service for McMaster University students. SHEC focuses on engaging with students about health-related issues through performances, peer support, fundraisers, and events. The service offers peer support, anonymous and confidential pregnancy testing, a resource library, condoms, lubricant, and menstrual products. SHEC's space is located in MUSC 202.

Women + Gender Equity Network

WGEN is a service that caters to women, transfolk, people who identify outside the gender binary, and all survivors of sexual assault. WGEN provides a safe(r) space and resource library on campus in MUSC 204. Volunteers in the space offer peer support and the service also runs a support group for survivors of domestic and intimate partner violence.

Pride Community Centre

The Pride Community Centre is a service of the McMaster Students Union. We provide a contact point for McMaster students that may identify as gay, lesbian, bisexual, transgender, queer, and/or any of the other diverse identities that make up our community. We offer educational programming and access to resources of interest, as well as peer support and a physical space for students to meet and socialize with each other. As advocates for gender & sexual diversity, the PCC's mandate upholds that LGBTQ+ students are entitled to a safe and supportive campus, absent of homophobia and transphobia, where the expression of one's gender & sexual identity is welcomed and respected.