

Faculty of Engineering  
 McMaster University  
 Term 2 (January – April 2025)



**MECH ENG 715**  
**Biomechanics of Injury and Prevention**  
 cross-listed as BIOMED 715  
 (updated 09-July-2024)

**Instructor:** G. Wohl  
**Email:** wohlg@mcmaster.ca

**Lecture:** Thursday, 9:30 AM-12:30 AM (**start Jan 9**)  
**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	09-Jan	Introduction – concept of injury
2	16-Jan	Impact and energy dissipation + introduction to injury prevention
		Biological tissues – structure and organization
3	23-Jan	Tissue biomechanics and adaptation
4	30-Jan	Mechanisms of injury
5	06-Feb	Lower extremity injuries
6	13-Feb	Upper extremity injuries
7	20-Feb	Neck and trunk injuries
8	27-Feb	Head / brain injuries
9	06-Mar	Models of Injury Mechanisms
		Collision Severity and “Delta-V”
10	13-Mar	Methods of injury prevention (seat belts, air bags, helmets)
	20-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](http://www.turnitin.com)

Class ID: **TBD**

Enrolment password: **TBD**

**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.*