

MICB 302 - Immunology

Lectures: Tuesdays and Thursdays 9:30 – 10:50 AM in room Wesbrook 100

Instructors:

Dr. Mike Gold Office: Room 3501 Life Sciences Centre (2350 Health Sciences Mall);
E-mail: mgold@interchange.ubc.ca

Dr. Hung-Sia Teh Office: Room 3509 Life Sciences Centre; E-mail: teh@interchange.ubc.ca

Office hours for instructors: Fridays 9:30-10:30 AM (you will need to check in at the LSC Administration Office first and exchange ID for a keycard that will let you upstairs)

Course objectives:

- To gain an in-depth understanding of the cells and molecules of the immune system and how they work together to protect us from pathogens
- To reinforce and build upon important concepts in immunology and cell biology that were developed in MICB 202 and BIOL 200
- Prerequisite for MICB 402, MICB 412

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

1. Identify the major mechanisms (inflammatory responses, cytotoxic T cells, antibodies) by which immune cells protect us from different types of pathogens (viruses, extracellular bacteria, intravesicular bacteria, parasites) or from cancer cells.
2. Understand how immune cells detect the presence of pathogens and cancer cells (pattern recognition receptors, antigen receptors, antigen presentation pathways, NK cell receptors).
3. Describe processes that lead to the elimination of pathogens (e.g. opsonization, phagocytosis, neutralization, complement activation, cell-mediated cytotoxicity).
4. Describe the structure and function of key molecules that mediate immune responses including antibodies, antigen receptors, Toll-like receptors, MHC proteins, cytokines, chemokines.
5. Describe the main cell types of the immune system including their development, function, and for lymphocytes, how they generate antigen receptors.
6. Describe how defects in immune cell regulation can lead to immunodeficiency diseases or autoimmune diseases.
7. Describe the topics of current immunological interest including vaccines, immune tolerance, allergies, and transplantation.
8. Describe the basis for and application of current experimental approaches in immunology including flow cytometry, monoclonal antibodies, immunofluorescence, knockout and transgenic mice, adoptive transfer of immune cells, and gene expression profiling.
9. Relate processes that occur in immune cells to similar processes that occur in all cell types and which have been described in previous cell biology courses (e.g. mRNA splicing, protein secretion, receptor signaling).

Required textbook: Janeway's ImmunoBiology, 7th edition or 6th edition

- We will cover selected material from Chapters 1 to 11, 7th edition, 1 to 10, 6th edition.
- Copies of this text are on reserve at Woodward library
- A complete listing of sections to be covered will be provided for both editions

Prerequisites and assumed background for this course:

- **MICB 202 (Intro to Immunology)** We will assume that you are familiar with the major concepts in immunology that were discussed in MICB 202. We will go over some of the key points, but please review your notes from this course.
- **BIOL 200 or equivalent (basic Cell Biology)** We will assume that you are familiar with cellular organization and the functions of various organelles, the basic structures of DNA, proteins and membranes, and important cellular functions including transcription, mRNA splicing, translation, and protein secretion. Please look at relevant sections in the "Essential Cell Biology" or "Molecular Biology of the Cell" textbooks to refresh your memory.

The purposes of the lecture period are:

- To convey the important concepts that you will need to know for the exams using figures from the textbook as well as other figures to enhance your understanding of the material.
- To point out areas that are topics of active research in immunology.

Note that simpler aspects of the lecture notes, especially material covered in detail in MICB 202, may not be discussed in the lecture periods. Instead, we will ask you to read these sections of the notes before the lecture period.

Tutorials: There are four tutorial sections. Please attend the session that you are registered for.

Tutorial sections:

Section 1	Tuesday 1-2 PM	IRC 5
Section 2	Wednesday 8-9 AM	Wesbrook 201
Section 3	Thursday 11 AM-noon	IRC 4
Section 4	Friday 10-11 AM	IRC 5

Note: Tutorials will start week 3 (Sept. 15-19)

The objectives for the tutorial sessions are:

- To review the more difficult concepts covered in the lecture period.
- To address questions about the material
- To discuss techniques that are used in immunology research
- To go over the review questions for each of the chapters covered (review questions will be posted on the web site the week before the tutorial sessions at which they will be discussed; answers will be posted on the web site the week after the tutorial).
- To go over questions from past exams (also to be posted on the web site).

MICB 302 WebCT site: Login at <https://www.elearning.ubc.ca/home/index.cfm>

The purposes of the web site are:

- To post lecture notes, figure sets, review questions, past exams, and other study aids.
- To provide a forum for students to exchange views about the course and the course material (bulletin board).
- To post news items and research items relating to current developments in immunology research.
- The research questions for the exams (see below) will be posted on the web site.

For your information:

Tuesday, 16 September 2008: Last day for change in registration and for withdrawal from most Term 1 courses without withdrawal standing of "W" recorded on a student's academic record. Last day for change between credit and audit for Term 1 courses.

Friday, 10 October 2008: Last day for withdrawal from most Winter Session Term 1 courses with withdrawal standing of "W" recorded on a student's academic record.

Teaching approach, how to study, what you need to know:

1. In the lecture periods, we will discuss the major concepts using figures from the textbook, as well as other figures, to enhance your understanding of the material. In many cases, we will draw diagrams that explain the concepts. The figures and diagrams will illustrate the most important concepts. When you study for the exams, make sure that you can explain the figures and diagrams to yourself.
2. A set of **lecture notes** and **accompanying Powerpoint figures** will be posted on the web site the day before each class. If you print these out and bring them to class, then during class you can focus on listening and thinking without having to write everything down. However, you should copy any hand drawn diagrams, as these will not be posted on the web site.

For the exams, you will be responsible for all of the material covered during the lectures. This includes the lecture notes as well as the concepts/information contained in all figures and diagrams shown or drawn during the lecture. Simpler aspects of the lecture notes, especially material covered in detail in MICB 202, may not be discussed in the lecture periods and you will be asked to read these sections on your own.

3. Use the **textbook** to gain a better understanding of the material. During the lectures, we will indicate for each chapter which sections and figures are the most relevant. Focus on the text that relates to the concepts and figures we have covered in the lecture notes. The textbook is excellent and we encourage you to use it.

For the exams, you will not need to know details that are in the textbook but not covered in the lecture notes. Focus on the list of “important points” from each lecture and on concepts related to the learning objectives indicated on page 1 of this syllabus.

4. As we go along, we will post on the web site **review questions** for each chapter of the textbook. Try to answer the **review questions** on your own or discuss them with classmates.
5. If you have questions or need help understanding the material:
 - Talk to your classmates or post your question on the **bulletin board** (on the web site). Often, the best explanations come from people who are learning the material at the same time as you. We encourage you to work in groups and to teach each other. Student-to-student learning is often the most effective mode of learning.
 - Ask questions in the tutorials.
 - Ask questions in class. Note that the instructor may ask you to see them after class or at office hours if a long answer is necessary.
 - E-mail your TA or the instructor
 - See the instructor during their office hours.
6. Keep up with the material; don't leave everything for the week before the exam. There is a great deal of material and the later material builds on earlier material. It will be hard to understand subsequent chapters if you are not familiar with the concepts from the earlier chapters.

Exams and assignments:

1. The research question assignment will be worth 10% of the final grade.

- a) As we go through the course material, the instructors will point out areas that are currently the subject of intense research or where major new findings have been made recently. A list of these research areas will be posted on the web site. You will be asked to either read a recent paper from the primary literature or look up information related to a specific topic.
- b) In class, on **Tuesday October 14** you will address **2 research questions of your choice** by writing a short (<1 page) summary that describes in your own words the major findings and why they are important. You can prepare your answer ahead of time and reproduce them in class (no notes allowed though). There will also be a research question on the final exam, based on a separate set of research questions.
- c) To receive full credit, it should be obvious that you did some reading in a major scientific journal (not a newspaper or Time Magazine) and then wrote a scientific summary containing information that was not discussed in class. See the info at the bottom of this page for how to find out about current research in immunology.

2. The mid-term is worth 30% of the final grade.

- a) It will be held on **Thursday October 16 during the normal class period** and will cover the material in chapters 1-5.

3. The final exam is worth 60% of the final grade.

- a) It will be held during the final exam period. It will focus on chapters 6-10. However, since the material in chapters 6-10 builds on earlier material, you will need to be familiar with the major concepts from the first half of the course.

4. The exams will consist of short answer or short essay questions. Most questions can be answered with several sentences, or at maximum with 1-2 paragraphs. It is OK to present your answer in point form and diagrams often help. Clear and concise writing is better than a large volume. Responses that have the right answer, but also lots of incorrect information, may receive lower scores than responses that are completely correct.

Tip: Outline your response first, as opposed to writing a “stream of consciousness” answer.

To learn about immunology research, you can search topics on the PubMed web site (<http://www.ncbi.nlm.nih.gov/entrez/>) or you can read review articles in journals such as “Trends in Immunology”, “Nature Reviews Immunology”, and “Current Opinion in Immunology”. You can also look in journals that have both original research articles and short review articles such as “Nature Immunology” and “Immunity”. These journals are available electronically through the UBC library. Go to the UBC library web site, click on “e-journals”, and then search for the journal name. Follow the instructions until you get to the journal home page. You can browse recent issues or search key words.

To access these journals through the UBC library web site from off campus, you will need to set up a web proxy using your library card number and associated password or use the VPN protocol. Instructions for setting up a web proxy and VPN protocol are on the UBC library web site.

Approximate Schedule of Lectures

<u>Dates</u>	<u>Chapter</u>	<u>Topics</u>
Sept 2, 4, 9, 11	Chapters 1, 2	Components of the immune system, Overview of immune responses, Innate Immunity
Sept 11, 16	Chapter 3	Antigen recognition by B-cell and T-cell antigen receptors
Sept 18, 23	Chapter 5	Antigen presentation to T lymphocytes
Sept 25, 30 Oct 2, 7	Chapter 4	The generation of lymphocyte antigen receptors
Oct 9, 14	Chapter 6	Signaling by immune system receptors
Oct 14	In-class assignment (Research questions)	
Oct 16	Mid-term exam	(Chapters 1 to 5)
Oct 21, 23, 28, 30	Chapter 7	The development and survival of lymphocytes
Nov 4, 6	Chapter 8	T cell-mediated immunity (Dr. Teh)
Nov 13	Chapter 9	The humoral immune response (Dr. Teh)
Nov 18, 20	Chapter 10	Dynamics of adaptive immunity (Dr. Teh)
Nov 25, 27	Chapter 11	The mucosal immune system (Dr. Teh)
Dec exam period	Final exam	(Chapters 6 to 11, 7ed, 6 to 10, 6ed)

Complete list of relevant textbook sections for Mike Gold's portion of MICB 302 (chapters 1-6), in the order in which we will cover them.

Remember, you are only responsible for the portions of these sections that we cover in class. You will not be responsible for details that are in the book, but not in the lectures.

Week 1: Overview of the immune system

7th edition Sections 2-1, 2-2, 2-3, 1-2, 1-3, 1-4, A-14, A-22, A-23, A-35, 1-5, 1-6, 2-4, 2-5, 1-7, 1-8, 1-9, 1-10, 1-15, 1-16, 1-17, 1-18

6th edition Sections 2-1, 2-2, 1-1, A-14, A-22, A-23, A-35, 1-2, 1-5, 2-3, 2-4, 1-6, 1-7, 1-8, 1-9, 1-13, 1-14, 1-15

Week 2: Overview of the immune system, innate immune system

7th edition Sections 1-15, 2-30, 1-6, 1-19, 1-20, 1-23, 2-6, 2-7, 2-8, 2-9, 2-10, 2-27, 2-28, 6-27, 2-25, 2-26, 2-31, 2-32

For your interest: Section 2-24 (chemokines), chapter 16 (Evolution of the immune system), Sections A-46 and A-47 (transgenic mice, knockout mice)

6th edition Sections 1-2, 1-3, 1-4, 2-27, 1-5, 1-16, 1-17, 1-18, 2-5, 2-6, 2-7, 2-8, 2-9, 2-24, 2-25, 6-17, 2-22, 2-23, 2-28

For your interest: Section 2-21 (chemokines), chapter 15 (Evolution of the immune system), Sections A-46 and A-47 (transgenic mice, knockout mice)

Weeks 2-3: Antigen recognition

7th edition Sections 2-34, 3-1, 3-2, 3-3, 3-4, 3-5, 3-6, 3-7, 3-8, 3-9, 4-12, 4-13, 4-16, A-5, A-12, 6-8, 3-10, 3-11, 3-12, 3-13, 3-16, 3-17, 3-18, 3-19, A-28

6th edition Sections 2-29, 3-1, 3-2, 3-3, 3-4, 3-5, 3-6, 3-7, 3-8, 3-9, 4-16, 4-19, 4-20, A-5, A-12, 6-7, 3-10, 3-11, 3-12, 3-13, 3-14, 3-15, 3-18, 3-19, A-28

Weeks 3-4: Antigen presentation

7th edition Sections 5-1, 5-2, 5-3, 5-4, 5-5, 5-6, 5-7, 5-8, 5-9, 5-10, 3-14, 3-15, 5-11, 5-18, 5-12, 5-13, 5-16, 5-14, 5-15, 5-19

6th edition Sections 5-1, 5-2, 5-3, 5-4, 5-5, 5-6, 5-7, 5-8, 3-16, 3-17, 3-15, 5-9, 5-11, 5-12, 5-13, 5-16, 5-17, 5-14, 5-15

Weeks 4-6: Generation of antigen receptors

7th edition Sections 4-1, 4-2, 4-3, 4-6, 4-7, 4-4, 4-5, 4-8, 4-15, 4-16, 4-14, 4-20, 4-19, 4-9, 4-10, 4-11

6th edition Sections 4-1, 4-3, 4-6, 4-7, 4-4, 4-5, 4-15, 4-16, 4-17, 4-18, 4-11, 4-12, 4-13

Week 6-7: Signal transduction

(You will not be responsible for these sections on the midterm, only on the final exam)

7th edition Sections 6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 6-7, 6-8, 6-9, 6-10, A-18, 6-15, 6-16, 6-17, 6-18,

6th edition Sections 6-1, 6-2, A-18, 6-4, 6-5, 6-6, 6-7, 6-8, 6-9, 6-10, 6-11, 6-12, 6-16

Complete list of sections for Mike Gold's segment (7th edition)

Chapter 1: Sections 1-1 through 1-10, 1-15 through 1-20, 1-23

Chapter 2: Sections 2-1 through 2-10, 2-25 through 2-28, 2-30 through 2-32, 2-34

Chapter 3: Sections 3-1 through 3-19

Chapter 4: Sections 4-1 through 4-16, 4-19 through 4-20

Chapter 5: Sections 5-1 through 5-16, 5-18 through 5-19

Chapter 6: Sections 6-1 through 6-10, 6-17, 6-18

Appendices (methods): Sections A-5, A-12, A-14, A-18, A-22, A-23, A-28

For your interest: Sections 2-24, A-46, A-47, chapter 16

Complete list of sections for Mike Gold's segment (6th edition)

Chapter 1: Sections 1-1 through 1-9, 1-13 through 1-18

Chapter 2: Sections 2-1 through 2-9, 2-22 through 2-29

Chapter 3: Sections 3-1 through 3-19

Chapter 4: Sections 4-1, 4-3 through 4-7, 4-11 through 4-13, 4-15 through 4-20

Chapter 5: Sections 5-1 through 5-9, 5-11 through 5-17

Chapter 6: Sections 6-1, 6-2, 6-4 through 6-12, 6-16, 6-17

Appendices (methods): Sections A-5, A-12, A-14, A-18, A-22, A-23, A-28

For your interest: Sections 2-21, A-35, A-46, A-47, chapter 15

List of relevant textbook sections for Hung-Sia Teh's portion of MICB 302

You are only responsible for sections we cover in class. You are not responsible for details in the book that are not in the lectures.

Week 8: Lymphocyte development

Development of B lymphocytes: 7th edition, Sections 7-Intro, 7-1 to 7-6;
6th edition, Sections 7-Intro, 7-1 to 7-3, 7-8 to 7-11, 7-17.

T cell development in the thymus: 7th edition, Sections 7-7 to 7-10;
6th edition, Sections, 7-4 to 7-7.

Week 9: Lymphocyte development

T cell development in the thymus: 7th edition, Sections 7-11 to 22;
6th edition, Sections 7-12 to 7-16, 7-18 to 7-25.

Week 10: T cell-mediated immunity

7th edition, Sections 8-Intro, 8-1 to 24, 8-27 to 33;
6th edition, Sections 8-Intro, 8-1 to 18, 8-21-29.

Week 11: The humoral immune response

7th edition, Sections 9-Intro, 9-1 to 9-25;
6th edition, Sections 9-Intro, 9-1 to 9-23.

Week 12: Dynamics of adaptive immunity

7th edition, Sections 10-Intro, 10-1 to 10-19;
6th edition, Sections 10-Intro, 10-1 to 10-12, 10-22 to 10-26

Week 13: The mucosal immune system

7th edition, Sections 11-Intro, 11-1 to 11-17;
6th edition, Sections 10-13 to 10-21.

Complete list of Hung-Sia Teh's sections from 7th edition

Chapter 7: Sections 7-Intro, 7-1 to 7-22.
Chapter 8: Sections 8-Intro, 8-1 to 8-24, 8-27 to 8-33.
Chapter 9: Sections 9-Intro, 9-1 to 9-25.
Chapter 10: Sections 10-Intro, 10-1 to 10-19.
Chapter 11: Sections 11-Intro, 11-1 to 11-17.

Complete list of Hung-Sia Teh's sections from 6th edition

Chapter 7: Sections 7-Intro, 7-1 to 7-25.
Chapter 8: Sections 8-Intro, 8-1 to 8-18, 8-21 to 8-29.
Chapter 9: Sections 9-Intro, 9-1 to 9-23.
Chapter 10: Sections 10-Intro, 10-1 to 10-26.