



## COURSE OUTLINE

This course describes the basic concepts of immunology and the application of immunochemistry to molecular, medical and veterinary biotechnology. Topics include antigens and antibodies, immune responses, vaccines, antibody diagnostics, immunosuppression, hypersensitivity, transplants, cancer, auto-immune diseases, immunodeficiencies (including AIDS), and current immunological techniques.

The course description is online @ <http://camosun.ca/learn/calendar/current/web/chem.html>

Ω Please note: the College electronically stores this outline for five (5) years only.  
It is **strongly recommended** you keep a copy of this outline with your academic records.  
You will need this outline for any future application/s for transfer credit/s to other colleges/universities.

### 1. Instructor Information

(a)	Instructor:	Jamie Doran, Ph.D.
(b)	Office Hours:	Monday, 10:00 am to 11:00 am Wednesday, 10:00 am to 11:20 am Thursday, 10:00 am to 11:00 am Friday, 11:30 am to 12:20 pm Everyone is welcome whenever my office door is open. Appointments may be made to meet at other times. Office hours will be extended prior to test dates.
(c)	Location:	Room 350C, Fisher Building, Lansdowne Campus
(d)	Phone:	(250) 370-3441
(e)	Email:	jdoran@camosun.ca

### 2. Intended Learning Outcomes

Upon completion of this course the student will be able to:

1. Evaluate fundamental aspects of the human immune system, and relate these to a wide variety of immunologically-based clinical conditions including allergies, transplant rejection and acceptance, autoimmune diseases and immunodeficiencies including AIDS.
2. Compare and contrast various types of antibody-based diagnostic tests, and various vaccine formulations.
3. Possess the hands-on experimental skills required to conduct the most commonly used immunological techniques including enzyme-linked immunosorbent assays (ELISA), latex bead agglutination assays, and Western-blotting detection of antigens.
4. Evaluate experimental design, design control experiments, and interpret data arising from basic immunological technologies.
5. Capably work in a level-1 biosafety laboratory.
6. Prepare, handle and store the types of solutions, buffers, reagents used RID, LADS, ELISA and western blotting immunological experiments, and capably use the related equipment.

### 3. Required Materials

(a) Text

Parham, P. 2009, *The Immune System*. 3<sup>rd</sup> ed. Garland Science, New York.

This book can be purchased at the Lansdowne Campus book store. Also, a copy of the textbook is available on loan through the Lansdowne Campus reserve library.

[Supplementary information from articles recently published in relevant journals, including Nature Immunology Reviews, will be provided as required, by request, or for general interest.]

(b) Other

### **Laboratory Manual, and Selected Course Notes and Lecture Slides. 2013 Edition**

This required course pack contains the laboratory manual, selected course notes, and selected lecture slides from the textbook. It can be purchased at the Lansdowne Campus Bookstore.

### **General Materials and Supplies**

Safety glasses Safety glasses are required when handling hazardous chemicals or biochemicals. Each student is required to provide her or his pair of safety glasses. Students lacking safety glasses when they are required will not be permitted to be in the laboratory.

Lab coats Lab coats are required for all experimental work in the laboratory. Each student is required to provide her or his own lab coat. Students lacking lab coats will not be permitted to be in the laboratory.

Latex gloves Latex or other 'non-allergenic' gloves *will be available in the lab* and are to be used when appropriate to protect the skin from potentially hazardous chemicals or, much more often, to protect labile biochemicals and immunochemicals from contamination or becoming degraded by enzymes from the skin.

Calculator A scientific calculator is required at times in the laboratory, in lecture, and during exams. Each student is required to provide her or his own scientific calculator. Cell phone-, tablet- and computer-based calculators cannot be used during term tests or the final exam.

### **4. Course Content and Schedule**

Credits 4 credits

In-class workload 6 hours per week

- There are three 50-minute lectures per week. Term test review periods will be scheduled into an appropriate lecture slot prior to each test.
- Experiments, pre-lab talks & post-lab analyses are conducted during most of the 1 h & 50 min Tuesday laboratory periods. This time slot is also used for the two term tests and for a final exam review.

Out-of-class workload 6 hours per week

Number of weeks 14 weeks

Pre-requisite Chem 120 - College Chemistry 1

### **Course times and locations**

Chem 251 Section 001

#### Lectures

Mondays, 11:30 AM to 12:20 PM  
Fisher Building, Room F360

Wednesdays, 11:30 AM to 12:20 PM  
Fisher Building, Room F360

Thursdays, 11:30 AM to 12:20 PM  
Fisher Building, Room F360

#### Laboratory Experiments & Term Test Times\*

Wednesday, 2:30 PM to 5:20 PM  
Fisher Building, Room F360

*\* Please see the laboratory and term test schedule below.*

## Lecture Outline

### HISTORICAL PERSPECTIVE

*This topic is briefly introduced in the introduction (pages 1-2) to Chapter One of The Immune System, 3<sup>rd</sup> ed. by Peter Parham. More extensive reading relevant to the initial lectures is provided in the selected course notes in the course package under the heading "Historical Perspective on the Field of Immunology".*

- Early historical evidence of immunity in humans
  - Earliest evidence of the phenomenon of 'immunity'
  - Recognition of the four basic tenants of adaptive immunity
- Variolation & the early evidence of vaccination
- Development of Jenner's small pox vaccine
- Development of the field of immunology
  - Louis Pasteur (1860's- 1890's) creates the field of immunology with seminal experiments demonstrating vaccination and acquired immunity in animals and humans.
  - Pasteur and Koch compete to create widely-accepted vaccines.
  - Metchnikoff establishes the field of cellular immunology (1880's)
  - Nuttall (1888) & Von Behring (1888-1890's): humoral immunity
  - Wright (1903): synergy of cellular and humoral immunity.
  - Paul Erlich (early 1900's-1915): furtherance of understanding.
  - Border (early 1900's): immune responses to non-pathogenic cells
  - Lansteiner (early 1900's): blood group, ABO antigens.
  - Ramon (1928): toxoids (attenuated chemicals) as vaccines
  - Kabat (1930's): isolated immunoglobulins (antibodies) from blood
  - Chase (1940's): demonstrates transfer of cellular immunology
  - *(Note the list of Nobel Prize winning immunologists at the end of the selected notes.)*
  - A history of vaccine use proves the efficacy of stimulating immunity to prevent major human infectious diseases.
  - Introduction to protective immunity & vaccination

### GENERAL ROLE FOR THE IMMUNE SYSTEM IN MAINTAINING BODY INTEGRITY

*Refer to Chapter 1, sections 1-1, 1-2, 1-5, 1-6 & 1-8 to 1-13*

- Challenges to health: infectious organisms, cancer, toxins
- Innate immunity 'versus' adaptive immunity
- The lymphatic system (will be integrated with discussion of innate immunity, below)
  - Primary and secondary lymphatic tissues
  - Structure and function of the lymphatic system as it relates to immunity
- Primary immune responses vs. secondary immune responses

### THE INNATE IMMUNE RESPONSE

*Refer to:*

*Chapter 1, sections 1-3, 1-4 & 1-7;*

*Chapter 2, sections 2-1, 2-5, 2-10, 2-11, 2-13 to 2-16, 2-2, 2-3, 2-6 to 2-9, 2-18, 2-17, 2-20 to 22;*

*Chapter 9, sections 9-17 & 9-19;*

*"Innate Immunity" on pages 193 to 200 in the selected course notes in the course package.*

- General characteristics of nonspecific physical and chemical defenses
  - Physical barriers
    - Skin and mucous membranes
  - Defensive chemicals
    - pH, lysozyme, iron-binding compounds, O<sub>2</sub>, others
  - Natural bacterial flora and microbial antagonism
- White blood cells (leukocytes) involved in innate immunity
  - Phagocytic cell types: monocytes & macrophage, neutrophils (PMN's), dendritic cells, Langerhans cells
  - Nonphagocytic leukocytes: eosinophils, natural killer cells
  - Inflammatory leukocytes: mast cells, basophils
  - Lymphocytes: B-cells and T-cells
  - Origins of myeloid and lymphoid cell lines
- The innate, acute, inflammatory response
  - Constriction and local dilation of vessels
  - Roles for cells and soluble factors from the blood
  - Margination, extravasation (diapedesis), chemotaxis
  - Mast cell activity, soluble mediators
- The process of phagocytosis by macrophage
  - Antigen presentation links innate immunity with adaptive immunity
  - Oxygen-dependent and oxygen-independent killing mechanisms
  - Microbial strategies for the prevention of phagocytic killing
- Cytokines, an Introduction.
  - General nature and characteristics
  - Autocrine and paracrine functions

- Classic characteristics: pleotrophy, redundancy, synergy, antagonism
- Cytokines, other humoral factors, and cell receptors involved in innate immunity
  - Interferons  $\alpha$  and  $\beta$
  - Chemokines
  - Toll-like receptors
  - C-reactive protein & other acute phase proteins
  - Adhesion molecules
  - Broad picture of cytokine-mediated immunoregulation
- Complement
  - Classical complement pathway
  - Alternative complement pathway
  - Lectin-mediated complement activation pathway
  - Roles of products of complement activation and other acute phase proteins in the inflammatory response and other aspects of immunity.
- Natural killer (NK) cells
  - NK-cells: roles in innate immunity: killing mechanism

#### ADAPTIVE IMMUNITY & THE PRINCIPLE OF CLONAL SELECTION

*(some information will be introduced earlier in the curriculum to support laboratory experiments)*

*Browse Chapter 3 for a general overview of material detailed in following chapters.*

- Basic nature of antibodies & T-cell receptors
- Antigen, immunogen, and haptens
  - Epitopes (antigenic determinants)
  - Characteristics and properties of immunogens
  - Experimental conditions that affect the immunogenicity of immunogens
  - Vaccination conditions that affect the immunogenicity of immunogens

#### ANTIBODIES - STRUCTURE & DIVERSITY

*(some information will be introduced earlier in the curriculum to support laboratory experiments)*

*Refer to Chapter 4, sections 4-1 to 4-16.*

- Antibodies
  - Structure and function of a prototypic, divalent Ab molecule
    - ◇ Fab and Fc fragments
    - ◇ Globular constant domains
    - ◇ Variable and hypervariable (CDR) regions
  - Isotypes (classes) of antibodies
    - ◇ Classes of heavy and light chains
    - ◇ Immunological characteristics and functions
  - Idiotypes
- Genetics of antibody diversity Antibody production by B-cells
  - Multi-gene organization of immunoglobulin genes
  - Variable region gene rearrangements
  - Generation of antibody diversity
  - Class switching
- Monoclonal Antibodies (MAbs) (material presented in conjunction with MAb labs)
  - Technical means of producing MAbs
  - Roles of MAbs as drugs
  - Roles of MAbs in drug targeting
  - Roles of MAbs in diagnostics

#### B-CELL ACTIVATION & ANTIBODY EFFECTOR FUNCTIONS

*Refer to:*

*Chapter 6, Introduction, sections 6-1 & summary (browse chapter for interest);*

*Chapter 9, sections 9-1 to 9-17 & 9-20 to 9-25;*

*Chapter 10, sections 10-5 to 10-9, 10-11 to 10-19.*

- Development & processing of B-cells
- Antibody production by B-cells
  - Clonal selection and antibody synthesis
  - B-cell receptors and antigen binding
  - B-cell activation and maturation
    - Plasma cells
    - Memory B-cells
  - Affinity maturation
  - Relationship of affinity maturation to class switching
  - Relationship of affinity maturation to memory B-cells
- Antibody effector functions
  - Roles as adaptor molecule
  - Roles specific to classes (isotypes) of antibodies

- Antibody interactions with Fc receptors on macrophage, mast cells, basophils, eosinophils and natural killer (NK) cells.
  - ADCC (antibody-dependent cell-mediated cytotoxicity)
- B-cell Receptors & cell adhesion molecules
- Role of CD4 Helper T<sub>H</sub>2-cells in antibody production
- Role of CD4 Helper T<sub>H</sub>2 -cells in CD4 B-cell activation
- T-independent B-cell antigens
- Role of the lymphatic system
- The role of T-helper cell - B-cell interactions
  - Affinity maturation and isotype switching
  - Prevention of harmful effects of affinity maturation

#### T-CELL ANTIGEN RECOGNITION AND ACTIVATION, AND T-CELL MEDIATED IMMUNITY

*Refer to:*

*Chapter 7, Introduction and sections 7-1, 7-8 & 7-13;*

*Chapter 5, Introduction and sections 5.1, 5-4, 5-5 to 5.17 (browse the rest of Chapter 5);*

*Chapter 8, Introduction and sections 8-1 to 8-6;*

*Chapter 10, sections 10-5 to 10-6, 10-19 to 10-23, & 10-28 to 10-29.*

- Development and processing of T-cells.
- T-cell receptors
  - T-cell receptor diversity
  - Role of  $\alpha\beta$  receptors
  - role of  $\gamma\delta$  receptors
- MHC Presentation and T-cell Surface Proteins CD4 and CD8
  - Endogenous antigen processing
  - Exogenous antigen processing
  - Role of CD4 in recognition of MHC II
  - Role of CD8 in recognition of MHC I
  - 'T-cell restriction'
  - MHC polymorphism
- CD4 & CD8 T-cell subclasses
  - Cytotoxic T-cells, helper T-cells, regulatory T-cells
  - Clonal selection applies to cytotoxic T-cells
  - MHC I presentation & Tc-cell Activation
  - MHC II presentation & APC-cell Activation
- Roles of antigen-presenting cells (APC's)
  - Macrophage
  - Dendritic cells
  - Langerhans cells
  - B-cells
- Adhesion molecules: CD molecules, selectins, integrins, toll-like receptors
- Role of CD4 Helper T<sub>H</sub>1-cells in CD8 cytotoxic T-cell activation
- Activity of cytotoxic CD8 T-cells
- Role of CD4 Helper T-cells in CD8 cytotoxic macrophage activation
- Role of CD4 Helper T<sub>H</sub>2 -cells in CD4 B-cell activation
- T<sub>H</sub>1 vs. T<sub>H</sub>2 Responses
  - Humoral vs. cellular immune responses
  - Cytokine profiles
  - Polarization (humoral vs. cellular) of immune responses
  - Functions of cytokines in mediating polarization
- Activity of cytotoxic CD8 T-cells

#### EVASION OF THE IMMUNE SYSTEM BY PATHOGENS

*Refer to:*

*Chapter 11, sections 11-1 to 11-25;*

*Chapter 10, sections 10-1 to 10-4.*

*Handout materials will present very recent developments.*

- Influenza virus
- Malaria
- Trypanosomes
- Herpes virus
- Other pathogens

#### IMMUNODEFICIENCY

*Refer to Chapter 11, sections 11-8, 11-11 to 11-25.*

*Handout materials will present very recent developments.*

- Primary immunodeficiencies
- Secondary immunodeficiencies including AIDS

## HYPERSENSITIVITY (Allergy)

Refer to Chapter 12, sections 12-1 to 12-24.

Handout materials will present very recent developments.

- The nature of hypersensitivity and allergens
- Types of hypersensitivity
  - Immediate-type hypersensitivity
    - Type 1 - Anaphylactic hypersensitivity
      - ◇ Systemic anaphylaxis
      - ◇ Localized anaphylaxis
    - Type 2 - Antibody-dependent cytotoxicity hypersensitivity
    - Type 3 - Complex-mediated hypersensitivity
      - ◇ Systemic
      - ◇ Localized
  - Delayed type hypersensitivity
    - Type 4 - Cell-mediated hypersensitivity
- Allergy rates and the hygiene hypothesis

## IMMUNOTOLERANCE

- Significance of immunotolerance to health
- Mechanisms of immunotolerance
  - Self-tolerance
    - Immunological silence
      - ◇ Central tolerance
      - ◇ Peripheral tolerance
      - ◇ Cross-tolerance
    - Immunological ignorance
  - Functional tolerance

## AUTOIMMUNITY

Refer to Chapter 13, sections 13-1 to 13-12, 13-13 to 13-17, 13-20 to 13-26.

Also refer to the Selected Course Notes.

Handout materials will present very recent developments.

- Major sources of autoimmunity
- Autoimmune diseases
  - Tissue-specific diseases
    - Aspermatogenesis
    - Sympathetic ophthalmia
    - Hashimoto's thyroiditis
    - Insulin-dependent diabetes
    - Autoimmune anemias
      - Pernicious anemia
      - Hemolytic anemias
    - Goodpasture's syndrome
    - Graves disease
  - Systemic autoimmune diseases
    - SLE (Lupus)
    - MS
    - Rheumatoid arthritis

## TRANSPLANTATION IMMUNOLOGY

Refer to Chapter 15, sections 15-1 to 15-7, 15-9, 15-11, 15-18, 15-24 & 15-25.

(Browse the remainder of Chapter 15).

- Autograft, isograft, allograft, xenograft
- Privileged sites & privileged tissues
- Graft rejection
  - Hyperactive rejection
  - Acute rejection
    - First-set rejection
    - Second-set rejection
  - Chronic rejection
- Prevention of rejection
  - Tissue typing
  - Immunosuppressive agents
- Clinical transplantation
  - Current status
  - Graft vs. host reaction
- Acquired immunotolerance
  - Low-zone tolerance

- High-zone tolerance
  - Immunotolerance created by certain immunization regimes
  - Natural acquisition of 'immunotolerance' in people
- Blood Group Antigens
  - Rh antigens and fetal hemolytic disease
  - ABO antigens and compatible blood donors

## VACCINES

Refer to Chapter 14, sections 14-1 to 14-10.

Handout materials will present very recent developments.

- Needs, benefits, and potential risks
- Type of vaccines
  - Killed or otherwise inactivated vaccines
  - Live attenuated vaccines
  - Subunit vaccines
    - Purified biomolecules
    - Recombinant vaccines
    - Peptide vaccines
    - DNA vaccines
    - Heterologous vaccines

## CANCER IMMUNOLOGY

Refer to Chapter 16, sections 16-1 to 16-14.

Handout materials will present very recent developments.

- Tumour-Specific transplantation antigens
  - Viral antigens
  - Chemically-induced tumour antigens
- Tumour-associated transplantation antigens
  - Carcinofoetal antigens
  - Embryonic antigens
  - Alpha-feto protein antigen
- Immune response to tumours
- Cancer immunotherapy
  - Cytokine therapy
  - Interferon therapy
  - Tumour necrosis factor therapy
  - Monoclonal antibody-based therapies
  - Anti-cancer vaccines

### Additional laboratory-lecture topics in Immuno-Diagnostic Formats:

- Radioimmunoassay (RIA)
- Immunofiltration assays
- Immunochromatographic assays
- Affinity chromatography
- Immuno-electron microscopy
- Immuno-fluorescence microscopy
- Fluorescence-activated cell sorter.

### Laboratory & Test Schedule

Thoroughly read the introductory material and experimental protocol(s) in preparation for each experiment.

Wednesday, September 3<sup>rd</sup>

Organization of the laboratory portion of the course; Perspective on the inter-relatedness of experiments; Overall lab orientation; Explanation of proper use of a variety equipment.

Lecture material also will be presented in this initial lab period.

Wednesday, September 10<sup>th</sup>

**Gel Immunodiffusion and the Identification of Antigens by Precipitin Reactions**

Pre-Lab Talk: Nature of Precipitin Reactions

**Experiment 1. The Ouchterlony Reaction**

**Experiment 2. The Radial Immunodiffusion Assay**

Lecture and lab-lecture material will be presented in this lab period.

Wednesday, September 17<sup>th</sup>

**Experiment 1 (continued). Interpretation of the Ouchterlony Reactions**

**Experiment 2 (continued). Interpretation of the Radial Immunodiffusion Assay**

Post-Lab Discussion - Interpretation of Precipitin Reactions

Pre-Lab Talk - Nature of Agglutination Reactions

**Experiment 3. Use of a Latex Bead Agglutination Assay to Identify *Aeromonas salmonicida*, a Bacterial Pathogen of Salmon and Trout.**

*Pre-Lab Talk - Principles of ELISA.*

**Experiment 4. Detection of *Aeromonas salmonicida* Antigens and Determination of Anti-*A. salmonicida* Polyclonal Antibody Titre Using an Indirect Enzyme-Linked Immunosorbent Assay (ELISA)**

**Part I. Coating of microtiter plate wells with antigens**

Wednesday, September 24<sup>th</sup>.

**Experiment 4. Detection of *A. salmonicida* Antigens and Determination of Anti-*A. salmonicida* Polyclonal Antibody Titre Using an Indirect Enzyme-Linked Immunosorbent Assay (ELISA)**

**Part II. Conducting the ELISA**

*Interpretation and discussion of ELISA results will occur in the following lecture period.*

Wednesday, October 1<sup>st</sup>.

*Pre-Lab Talk: SDS-PAGE in Western Blotting for the Detection of Specific Antigens.*

**Experiment 5. Western Blotting Analysis of *Aeromonas salmonicida* Proteins**

**Part I. SDS-polyacrylamide gel electrophoresis separation of proteins**

Thursday, October 2<sup>nd</sup>. (the following lecture period)

**Experiment 5. Western Blotting Analysis of *Aeromonas salmonicida* Proteins**

**Part II. Electrophoretic transfer of proteins onto nitrocellulose**

Wednesday, October 6<sup>th</sup>.

*Pre-Lab Talk: Western Blotting for the Detection of Specific Antigens.*

**Experiment 5. Western Blotting Analysis of *Aeromonas salmonicida* Proteins**

**Part III. Immuno-detection of antigens on western blots**

Wednesday, October 15<sup>th</sup>. **Term Test 1** 2:30 PM to 4:20 PM, Room F360

Wednesday, October 22<sup>nd</sup>.

**Experiment 5. Western Blotting Analysis of *Aeromonas salmonicida* Proteins**

Post-Lab Discussion - Interpretation of western blotting results

**Experiment 6. Differentiation and Titre Determination of Atlantic Salmon and Rainbow Trout Sera Using Monoclonal Antibodies in an ELISA Assay**

**Part I. Dilution of antigens, and coating of microtiter plates**

*Lecture and lab-lecture material will be presented in this lab period.*

Wednesday, October 29<sup>th</sup>.

**Experiment 6. Differentiation and Titre Determination of Atlantic Salmon and Rainbow Trout Sera Using Monoclonal Antibodies in an ELISA**

**Part II. Conducting the ELISA**

*Interpretation and discussion of ELISA results will occur in the following lecture period.*

Wednesday, November 5<sup>th</sup>.

**Experiment 8. Propagation of HEK293 Cells in Tissue Culture**

Part I. Lab lecture & demonstration - Introduction to techniques for the propagation of tissue cultures and use of laminar flow hood and biosafety hoods for sterile tissue culture work

Part II. Subculturing tissue cultures.

Wednesday, November 12<sup>th</sup>.

**Experiment 8. Propagation of HEK293 Cells in Tissue Culture**

Part III. Examination of tissue cultures.

*Pre-Lab Lecture: Creating Hybridomas for Producing Monoclonal Antibodies (MAB's)*

**Experiment 7. Monoclonal Antibody Production and Characterization**

**Part I. Propagation of Monoclonal Antibody Producing Hybridoma Tissue Cultures.**

Wednesday, November 19<sup>th</sup>. **Term Test 2** 2:30 PM to 4:20 PM, Room F360

Wednesday, November 26<sup>th</sup>.

**Experiment 7. Monoclonal Antibody Production and Characterization**

**Part II. Immuno-chromatography Isotyping of the Monoclonal Antibodies (MAB's) in the Hybridoma Tissue Culture Supernatants**

*Lab Lecture - Comparison of immunological techniques used for lab-based, field-based and OTC Immunodiagnostic assays.*



**Final Exam:** The time and location of the Chem 251 Final Exam will be published during the Fall Semester.

## 5. Basis of Student Assessment (Weighting)

(a) Tests

### Term Test #1

This exam covers relevant material from approximately the first third of the course. The delineation of material students are responsible for will be provided in class about one week before the date of the test. This is a 110 minute test that will be written on Wednesday, October 15<sup>th</sup> from 2:30 PM to 4:20 PM in F360. Students may choose to use the remainder of the lab time period if they like.

The results of this test contribute to **25%** of the final grade.

### Term Test #2

This exam covers relevant material from approximately the second third of the course. The delineation of material students are responsible for on this test will be provided in class about one week before the date of the exam. This is a 110 min. test that will be written on Wednesday, November 19<sup>th</sup> from 2:30 PM to 4:20 PM in F360. Students may choose to use the remainder of the lab time period if they like.

The results of this test contribute to **25%** of the final grade.

*If either of the term exams is missed due to illness, or other justifiable reason, with accompanying documentation then the percentage value of that term exam (25%) will be added to the percentage value of the final exam.*

(b) Final Exam

The final exam is a comprehensive exam that includes components from the laboratory section of the course. The value this exam contributes to the final grade is **45%**. The time and location of the final exam will be published by the College during the Fall Semester. *(Please note that the exam time and date cannot be changed to accommodate vacation or other personal plans.)*

**Attendance at the final exam is mandatory.** Appropriate documentation must accompany any explanation for absence if an incomplete grade (I grade) is warranted for medical or other reason.

(c) Other

### Laboratory Experiments

**Attendance in the lab periods is mandatory.** No laboratory experiment can be missed without an acceptable reason submitted in writing, such as a proper letter from a Medical Doctor.

Laboratory participation and performance contributes **5%** to the final grade.

### ***Please come to each lab period prepared for the experiment.***

There are no laboratory reports due for the experiments but *students are responsible for understanding the principles, technical bases, and results of each experiment.* These aspects of the laboratory work will be subject to examination on the term tests and the final exam.

## 7. Grading System

### Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D	Minimum level of achievement for which credit is granted; a course with a "D" grade cannot be used as a prerequisite.	1
0-49	F	Minimum level has not been achieved.	0

## Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy E-1.5 at [camosun.ca](http://camosun.ca) for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	<i>Incomplete:</i> A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	<i>In progress:</i> A temporary grade assigned for courses that, due to design may require a further enrollment in the same course. No more than two IP grades will be assigned for the same course. (For these courses a final grade will be assigned to either the 3 <sup>rd</sup> course attempt or at the point of course completion.)
CW	<i>Compulsory Withdrawal:</i> A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.

## 7. Recommended Materials or Services to Assist Students to Succeed Throughout the Course

A reading guide to the course text is provided for each topic (above). Supplementary course notes and copies of lecture slides that primarily present figures or tables from the text are provided in the course pack that also includes the Chem 251 Immunology Laboratory Manual. These notes support lectures and laboratory experiments by the provision of material on subjects that are not addressed in the sufficient detail in the text, or are addressed in less detail or from a different perspective. The copies of many selected lecture slides that present figures, tables or other complex or somewhat information-intensive materials will facilitate efficient note taking, and promote in-class learning and discussion.

## LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning. This information is available in the College calendar, at Student Services, or the College web site at [camosun.ca](http://camosun.ca).

## STUDENT CONDUCT POLICY

There is a Student Conduct Policy **which includes plagiarism**. It is the student's responsibility to become familiar with the content of this policy. The policy is available in each School Administration Office, at Student Services, and the College web site in the Policy Section.

*Please Note: Students may not use recording devices in the classroom without the prior permission of the instructor or DRC. The instructor's permission is not required when the use of a recording device is sanctioned by the College's Disabilities Resource Centre for Students in order to accommodate a student's disability, and when the instructor has been provided with an instructor notification letter which specifies the use of a recording device. Recordings made in the classroom are for the student's personal use only, and distribution of recorded material is prohibited. Recordings made during the course would include statements, questions and comments made by students in the class, and these are not to be disseminated or repeated in any manner based on the recordings.*