Biology 153 - Winter 2003

Anatomy and Physiology for Nursing

INTRODUCTION

Biology 153 is the second half of a two-semester course on the anatomy and physiology of the human body with applications to clinical nursing practice. The course traces anatomy and physiology of cells, tissues and selected organ systems. Themes, which will be integrated in the course, include physical assessment, diagnostic testing, basic pharmacology, chronicity, nutrition and development.

INSTRUCTORS

Biology

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Nursing

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TEXTS

Biology - Required

Martini, Frederic H. (2001). *Fundamentals of anatomy and physiology* (5th ed). Upper Saddle River, NJ: Prentice Hall.

Martini, Frederic H. & Kathleen Welch. (2001). *Applications Manual: Fundamentals of anatomy and physiology (*5th ed). Upper Saddle River, NJ. Prentice Hall.

Camosun College, Department of Biology. *Biology 153: Course Outline, Learning Objectives and Laboratory Directions* — Winter 2003

Optional

Seiger, Charles M. (2001). *Study Guide: Fundamentals of anatomy and physiology (*5th ed). Upper Saddle River, NJ. Prentice Hall.

Burton, G. R. W. & Engelkirk, P. G. (2000). *Microbiology for the health sciences* (6th ed). New York, Lippincott.

Nursing – Required

Dugas, B., Esson, L. & Ronaldson, S. (1999). *Nursing foundations: A Canadian perspective* (2nd ed.). Scarborough, Ontario: Prentice Hall Canada Inc.

Estes, M. (1998). *Health assessment & physical examination.* Toronto: Delmar Publishers.

Eisenhauer, L., Wemett, L., Spencer, R., & Burgan, F. (1998). *Clinical pharmacology & nursing management.* (5th ed.). New York: Lippincott.

Eisenhauer, A. et al (1998). *Study guide to accompany Clinical pharmacology & nursing management*. (5th ed). New York: Lippincott.

Lab requirements

1. Lab coat. Disposable lab coats are acceptable.
2. Binder for laboratory modules and assignments with lined and blank loose-leaf paper.
3. Coloured pencils.

EVALUATION

Your progress in learning about human anatomy and physiology will be assessed on a continuous basis using a number of methods. Marks may be awarded for assignments, quizzes and/or class participation and may vary among the sections. There will be penalties for safety violations, lack of attendance and punctuality for laboratory sessions. There will be two theory examinations during the term, a midterm laboratory examination and final comprehensive theory and laboratory examinations. Examination questions in Biology 153 will incorporate critical thinking and problem-solving. Theory examinations will include both the nursing (15%) and biology (85%) components of the course.

Exam #1	15%
Exam #2	20%
Lab (safety, attendance, etc)	5%
Midterm Lab Exam	10%
Final Comprehensive Lab Exam	15%
Final Comprehensive Theory Exam	35%
TOTAL	100%

Examinations will be given at times indicated on the Course Schedule. Assignments will be due at times as announced in class. There will be only ONE makeup examination and will only be granted for genuine emergencies, supported by documentation acceptable to the department. In case of illness or emergency, the student must notify the instructor **in advance** of the examination in order for alternate arrangements to be made. ***Note:*** *Vacation plans do not constitute an emergency.* Please see STUDENT RESPONSIBILITES.

The following grades will be applied to examinations and other forms of evaluation in this course.

A+	=	95% and over	C+	=	65% and over
A	=	90% and over	C	=	60% and over
A–	=	85% and over	D	=	50% and over
B+	=	80% and over	F	=	less than 50%
B	=	75% and over			
B–	=	70% and over			

STUDENT RESPONSIBILITIES

1. Attendance is important to ensure success. If unable to attend a session, the student is responsible for arranging with a classmate to obtain information such as notes, handouts and announcements.

2. If out of class assignments are given, students are expected to hand in the assignments to the instructor on time.

3. Late assignments will be accepted at the discretion of the instructor and only if the assignment has not been returned to other students. If the instructor agrees to accept a late assignment, there will be a penalty of 10% per day for each weekday. If an assignment is due on Friday, a penalty of 10% will be applied to Saturday/Sunday period.

4. Examinations must be written as scheduled. Exceptions will be made at the discretion of the instructor and only if documentation of the illness or emergency acceptable to the department is received. The student must notify the instructor **in advance** of the examination.

5. If acceptable documentation for missing a theory examination is received, the student will be given the opportunity to write a makeup examination in week 13 which will be valued at the percentage allocated to the missed examination(s). This makeup examination will include all material covered up to and including week 12.

6. If a student is unable to take the midterm laboratory examination and provides acceptable documentation, the mark allocated will be added to the final comprehensive laboratory examination.

7. If a student is unable to take the final laboratory examination and provides acceptable documentation, an oral laboratory examination will be given.

8. Any evaluation of work for in-class/lab assignments, reports and/or participation will not be given if a student is **not present for any reason.**

9. Students are expected to work independently on reports unless instructed that the evaluation is based on group effort and evaluation. Please see ACADEMIC MISCONDUCT.

ACADEMIC MISCONDUCT

Academic misconduct includes but is not limited to the following acts:

- Giving unauthorized information to another student or receiving unauthorized information from another student during any type of examination or test.
- Obtaining or providing, without authorization, questions or answers relating to any examination or test prior to the time of the examination or test.
- Using unauthorized sources of information during any examination or test.
- Asking or arranging for another person to take any examination or test in one's place.
- Plagiarizing, that is, appropriating the work of another or parts or passages of another's writing, or the ideas or language of the same, and passing them off as the product of one's own mind or manual skill.

According to Camosun College policy, the consequence for academic misconduct is receiving a grade of 'F' for the work involved or for the course.

10. Students must know and follow all Safety Rules and Procedures.

11. Students must sign the Safety Contract before participating in any laboratory activity.

12. Failure to follow the Safety Rules and Procedures will result in penalties at the discretion of the instructor.

13. Students must turn off cell phones and pagers during all lectures and laboratories.

14. All laboratories start punctually. Information necessary for performing the laboratory correctly and safely is given at the beginning of the lab. Therefore, students are expected to arrive at the labs before the scheduled start times in order to be prepared to begin the lab on time.

NOTE - Concerning spelling

Anatomy is a logical and precise study of a complex subject. The terminology used to describe the body's features is similarly complex. Because the terms have been developed over a period of hundreds of years and were drawn from several languages, especially Latin and Greek, learning their correct usage is a formidable task.

Mastering the usage of these terms will be important to you for several reasons. Correct usage (pronunciation and spelling) will

- foster self confidence
- help to earn the respect of your professional colleagues
- reduce the chances of practical mistakes which may cause harm (or embarrassment - consider the difference between washing the peroneal area and the perineal area)

You will be expected to use acceptable pronunciation and spelling for presentations and evaluations. Penalties for spelling errors will be applied. If writing is illegible, no marks will be given.

BIOLOGY 153 WINTER 2003

The following is a **tentative** schedule of lectures and labs. Any changes will be announced in class.

Week	Date	Lecture	Lab Activity
1	Jan 6 – 10	Unit V. Cardiovascular System (Continued from Biol 152)	Lab 1: Lab Safety Cardiovascular Anatomy review, Pulses and Blood Pressure
2	Jan 13 – 17	Unit V Cardiovascular System *Nursing – Cardiovascular 1 & 2*	Lab 2: Cardiovascular physiology: ECG
3	Jan 20 – 24	Unit VI Microbiology	Lab 3: Microbiology 1
4	Jan 27 – 31	Unit VI Microbiology *Nursing – Pharmacology*	Lab 4 Microbiology 2
5	Feb. 3 Feb 4 – 7	**EXAM #1** Unit VI Microbiology	Lab 5: Microbiology 3 Lymphatic System
6	Feb 10 – 14 Feb 13 – 14	Unit VII Lymphatic System Immunology *Nursing – Prevention of infection* Reading Break	 No lab this week
7	Feb 17 – 21	Unit VIII Respiratory System	**LAB EXAM #1**
8	Feb 24 – 28	Unit VIII Respiratory System *Nursing – Temperature & Respiratory regulation*	Lab 6: Respiratory System
9	Mar 3 – 7	Unit IX Digestive System	Lab 7: Respiratory Physiology
10	Mar 10 Mar 11 – 14	**EXAM #2** Unit IX Digestive System *Nursing – Nutrition, bowel elimination*	Lab 8: Digestive System/Nutrition
11	Mar 17 – 21	Unit X Urinary System	Lab 9: Urinary System/Urinalysis
12	Mar 24 – 28	Unit X Urinary System *Nursing – Urinary elimination*	Lab 10: Reproductive System
13	Mar 31 – Apr 4	Unit XI Reproductive System	**LAB EXAM #2**
14	Apr 7 – 11	UNIT XI Reproductive System	Lab: Reproductive System
15	Apr 14 – 25	**FINAL COMPREHENSIVE EXAM** College exam period Date TBA	

LEARNING OUTCOMES

Upon successful completion of Biology 152 and Biology 153, you will be able to:

- use your knowledge of normal anatomy and physiology to differentiate normal from abnormal when you are doing physical assessments of clients

- use and understand correct terminology when you are communicating with other members of the health care team

- use your knowledge of anatomy and physiology as a basis for further study of pathophysiology

- help clients by explaining basic anatomy and physiology, nutrition and pharmacology in the maintenance of health and prevention of disease.

Biology 153 is divided into units and is a continuation of Biology 152. The objectives listed include some objectives which have already been covered in Biology 152 and the prerequisite courses, (Biology 12 or 080 and Chemistry 11). These objectives will not be covered in classes and will be noted for you to review. It is important that you are familiar with this information in order to understand the other concepts. Students are expected to review these objectives and material covered in these objectives is testable.

N.B. You will obtain information from several sources including lectures, class discussions, text books, videos, labs and clinical courses. Do not rely exclusively on any one, or only some of the sources.

UNIT V: THE CARDIOVASCULAR SYSTEM

****This unit is a continuation of Biology 152 Unit V. Refer to your Biol 152 Objectives for the detailed objectives.**

A. ANATOMY OF HEART AND VESSELS

1. **Review** the components of the circulatory system.

2. **Review** the location of the heart, its external and internal anatomy and blood supply.

3. **Review** the major circulatory subsystems: Pulmonary and Systemic (including the Coronary and Hepatic Portal Systems.)

4. **Review** the types of blood vessels, structure and function.

5. **Review** the names of the major blood vessels as listed in the Biol 152 handout and the areas these vessels serve.

B. BLOOD

1. **Review** the components and major functions of blood.

2. **Review** the composition and functions of plasma.

3. **Review** the origin, production and characteristics of the formed elements of blood.

4. **Review** the processes associated with hemostasis.

5. **Review** the concept of blood typing for ABO and Rh and the importance of incompatibility.

6. Take note of important hematology tests.

7. Explain the concept of baseline hematology blood values and their relevance to subsequent tests.

8. Analyze hematology laboratory reports and explain their clinical significance.

C. CARDIOVASCULAR PHYSIOLOGY

1. Explain cardiodynamics
   - 1.1 Define stroke volume and cardiac output and discuss the influencing factors.
   - 1.2 Explain effects of adjustments in stroke volume and cardiac output.
   - 1.3 Discuss factors that affect heart function.

2. Discuss the physiology of blood pressure, blood flow and capillary exchange.
   - 2.1 Explain the mechanisms that regulate blood flow through the vessels.
   - 2.2 Describe the factors that influence and regulate blood pressure.
   - 2.3 **Review** the mechanisms associated with the movement of fluids between capillaries and interstitial spaces.

3. Describe the cardiac cycle.
   - 3.1 Describe the events of an action potential in cardiac muscle and the importance of calcium ions to the contractile process.
   - 3.2 Discuss the function of nodal and conducting cells.
   - 3.3 Describe the components and functions of the conducting system of the heart.
   - 3.4 Explain the events of the cardiac cycle and relate the heart sounds to the specific events of the cycle.
   - 3.5 Explain the electrical events associated with an electrocardiogram.

4. **Review** the hormones that influence cardiovascular function.

UNIT VI: INTRODUCTORY MICROBIOLOGY

1. Discuss the history of the development of Medical Microbiology and Epidemiology and its significance to nursing practice.

2. Describe the major agents causing infectious diseases, mechanisms of pathogenesis and methods of control of microorganisms.

3. Bacteria
   - 3.1 Describe the structure of the bacterial cell.
   - 3.2 Describe the bacterial cell morphologies and arrangements.
   - 3.3 Briefly describe some bacterial mechanisms of pathogenesis.
   - 3.4 Describe physical and chemical methods for controlling microorganisms.
   - 3.5 List some common bacterial diseases.
   - 3.6 Discuss the importance of normal flora.

4. Viruses
   - 4.1 Briefly describe the structure of a typical virus.
   - 4.2 Be familiar with the variety of viral structures.
   - 4.3 Describe the life cycles of viruses.
   - 4.4 List some common viral diseases.

5. Miscellaneous agents of disease.
   - 5.1 Briefly discuss other agents of disease: Fungi, Protozoa, and Metazoan parasites.
   - 5.2 List some common examples of diseases in each category.

6. Discuss nosocomial infections.
   - 6.1 Define the term nosocomial.
   - 6.2 Discuss the prevalence of nosocomial infections.
   - 6.3 Identify examples of common nosocomial infections.
   - 6.4 Discuss the role of the health care professional in prevention and control of nosocomial infections.

UNIT VII: THE LYMPHATIC SYSTEM AND IMMUNOLOGY

1. List the general functions of the lymphatic system.

2. Describe the major structures and functions of the lymphatic system.
   - 2.1 lymphatic vessels - lymphatic capillaries, superficial and deep lymphatics, thoracic duct and lymphatic ducts.
   - 2.2 lymphocytes.
   - 2.3 lymphoid tissues.
   - 2.4 lymphoid nodules, gut associated lymphoid tissue and tonsils.
   - 2.5 lymphoid organs.

3. Discuss the nonspecific defenses.
   - 3.1 physical barriers.
   - 3.2 phagocytes.
   - 3.3 NK cells.
   - 3.4 interferons.
   - 3.5 complement.
   - 3.6 inflammation.
   - 3.7 fever.

4. Discuss the specific defenses (the immune system).
   - 4.1 distinguish between cell-mediated and humoral immunity.
   - 4.2 categorize immunity as acquired, innate, active and passive.
   - 4.3 describe the role of T cells in cell mediated immunity.
     - antigen presentation.
     - antigen recognition.
     - costimulation.
     - cytotoxic T cells, suppressor T cells and helper T cells.
   - 4.4 describe the role of B cells in humoral immunity.
     - B cell sensitization and activation.
   - 4.5 describe the role of antibodies in humoral immunity.
     - antibody structure.
     - classes of antibodies.
     - actions of antibodies.
   - 4.6 describe and distinguish between the primary and secondary responses to antigen exposure.

UNIT VIII: THE RESPIRATORY SYSTEM

1. List the main functions of the respiratory system.

2. Describe the organization of the respiratory system.
   - upper and lower respiratory systems.
   - conducting and respiratory portions.
   - respiratory mucosa.

3. Describe the gross and microstructure of the lungs
   3.1 visceral and parietal pleurae, the pleural cavities and their relationship to the mediastinum.
   3.2 alveoli and pulmonary interstitium.

4. **Review** pulmonary perfusion.

5. Describe the following aspects of respiratory physiology.
   5.1 Distinguish between internal, external and cellular respiration.
   5.2 Describe the mechanisms of pulmonary ventilation.
      - atmospheric pressure, intrapulmonary and intrapleural pressures.
      - muscle actions and pressure changes.
      - distinguish between quiet and forced breathing.
   5.3 Describe the influence of the following factors on ventilation.
      - airway resistance.
      - compliance.
      - interstitial elasticity.
      - surface tension (role of surfactant).
   5.4 Identify and distinguish between the following lung volumes and capacities.
      - tidal volume.
      - inspiratory reserve volume.
      - expiratory reserve volume.
      - residual volume.
      - vital capacity.
      - total lung capacity.
      - forced expiratory volume.

5.5 Describe the process of gas exchange at the respiratory membrane and in the tissues in terms of
- partial pressures (Dalton's Law).
- gas solubilities (Henry's law).
- the effects of :
  - respiratory membrane thickness.
  - solubility and diffusion coefficients.
  - surface area.
  - partial pressure differences.
- the coordination of blood flow and airflow in the alveoli.
- perfusion/ventilation imbalance.
- the coordination of blood flow and tissue hypoxia.
- loading and unloading of oxygen and carbon dioxide.

6. Describe how oxygen is transported in the blood including loading and unloading.
   6.1 oxygen-hemoglobin saturation/dissociation curve.
   - effect of temperature.
   - effect of pH (Bohr effect).
   - effect of BPG.

   6.2 the importance of fetal hemoglobin.
   6.3 the effects of carbon monoxide poisoning and high altitude on oxygen transport.

7. Describe how carbon dioxide is transported in the blood including loading and unloading.
   7.1 the interconversion of carbon dioxide, carbonic acid and bicarbonate.
   7.2 the role of carbonic anhydrase.
   7.3 the roles of the plasma and red blood cell in carbon dioxide transport.
   7.4 the function of carbaminohemoglobin.
   7.5 the chloride shift.
   7.6 the effect of carbon dioxide concentration on plasma pH.

8. Describe the control of ventilation.
   8.1 the location and role of the respiratory centers
   8.2 the chemical control of ventilation centers in terms of
   - chemoreceptor locations
   - effect of pH in the CSF
   - effect of pCO_2
   - effect of pO_2

   8.3 the baroreceptor reflexes

UNIT IX: THE DIGESTIVE SYSTEM

A. ANATOMY OF THE DIGESTIVE SYSTEM

1. Identify the organs of the digestive tract and associated accessory organs of digestion.
   - 1.1 Digestive tract: oral region, pharynx, esophagus, stomach, small and large intestine.
   - 1.2 Accessory organs: liver, gall bladder, pancreas.
   - 1.3 Hepatic, pancreatic and biliary ducts.

2. Describe the anatomical and histological characteristics of the organs of the digestive tract.

3. Describe the structure of the liver, gall bladder and pancreas.

4. Describe the membranes associated with the Gastrointestinal (GI) tract.
   - 4.1 Peritoneum (visceral and parietal)
   - 4.2 Falciform ligament
   - 4.3 Round ligament
   - 4.4 Greater omentum
   - 4.5 Lesser omentum
   - 4.6 Mesentery

B. PHYSIOLOGY OF THE DIGESTIVE SYSTEM

1. Describe the processes of digestion and absorption.
   - 1.1 Discuss the digestion and absorption of carbohydrates, lipids and proteins and the locations where these processes occur.
   - 1.2 Discuss the mechanisms by which water, electrolytes and vitamins are absorbed.
   - 1.3 Explain the functions of intestinal secretions and the regulation of secretory activities.

2. Describe the roles of the accessory organs in digestion and absorption and the regulation of their activities.
   - 2.1 Discuss the digestive functions of the liver.
   - 2.2 Discuss the digestive functions of the gall bladder.
   - 2.3 Discuss the digestive functions of the pancreas.

C. METABOLISM

1. **Review** metabolism and differentiate between anabolism and catabolism.

2. Describe the uptake, absorption and distribution of carbohydrates, lipids and proteins.

3. Differentiate amongst the terms:
   - glycogenesis
   - glucogenesis
   - gluconeogenesis
   - glycolysis
   - glycogenolysis

4. Differentiate between the absorptive and post-absorptive metabolic states and summarize the characteristics of each.

5. Explain what constitutes a balanced diet and the importance of a balanced diet.

6. Define Basal Metabolic Rate (BMR) and discuss factors involved in determining an individual's metabolic rate.

UNIT X: THE URINARY SYSTEM

A. ANATOMY OF THE URINARY SYSTEM

1. Describe the structural components and overall functions of the urinary system.

2. Describe the superficial and sectional anatomy of the kidneys.
   - 2.1 Describe the anatomy of the kidneys.
   - 2.2 Describe the structure of the nephron.
   - 2.3 Identify the blood vessels associated with each kidney and the blood flow through the kidney.

3. Describe the structure of the ureters, urinary bladder and urethra.

4. Describe the structural and functional differences between the male and female urethra.

B. PHYSIOLOGY OF THE URINARY SYSTEM

1. Describe the processes occurring in the nephron.
   - 1.1 Describe glomerular filtration, what is filtered and where it occurs.
   - 1.2 List and describe the factors that influence filtration pressure and the rate of filtrate formation.
   - 1.3 Identify the transport mechanisms along the nephron and discuss reabsorptive and secretory functions in the nephron segments and collecting ducts.
   - 1.4 Discuss voluntary and involuntary control of urination.

2. Describe the regulation of urine concentration and volume.
   - Loop of Henle and countercurrent exchange.

3. Describe the normal characteristics, composition and solute concentration of representative urine samples.

4. List and discuss the significance of laboratory tests of the urinary system.

5. Discuss specific hormones of the endocrine system associated with the urinary system and their significance.

6. Describe the role of the kidney in fluid, electrolyte and acid-base balance.
   - 6.1 Identify the fluid compartments.
   - 6.2 Describe the regulation of the concentration of the major ions.
   - 6.3 Describe the influences of thirst, kidney function and evaporation on water content.
   - 6.4 Describe the regulation of acid-base balance.

UNIT XI: THE REPRODUCTIVE SYSTEM

A. REPRODUCTIVE SYSTEM OF THE MALE

1. Identify and describe the reproductive organs of the adult male in terms of location, structure and function.
   - 1.1 Testes including seminiferous tubules, interstitial cells (cells of Leydig), Sertoli cells, rete testis, efferent ducts.
   - 1.2 Epididymis.
   - 1.3 Vas/ductus deferens, ejaculatory duct and urethra.
   - 1.4 External genitalia.
   - 1.5 Accessory glands.

2. Describe the process of spermatogenesis and relate the meiotic stages to the actual process in the seminiferous tubules.
   - 2.1 Describe spermatogonia, primary and secondary spermatocytes, spermatids, spermatozoa.
   - 2.2 Describe the location and function of sustentacular cells (Sertoli cells) and interstitial cells (cells of Leydig).

3. Explain the hormonal control of male reproduction.
   - 3.1 Identify the glands and the hormones produced.
   - 3.2 Describe the action of these hormones and their effects on the male.

B. REPRODUCTIVE SYSTEM OF THE FEMALE

1. Identify and describe the reproductive organs of the adult female in terms of location, structure and function.
   - 1.1. Ovaries.
   - 1.2. Uterine tubes.
   - 1.3. Uterus.
   - 1.4. Vagina.
   - 1.5. External genitalia.
   - 1.6. Accessory glands.

2. Describe the process of oogenesis in the ovaries.
   - 2.1. Describe oogonia, primary oocytes, primary and secondary follicles, graafian follicles, secondary oocyte, polar bodies.
   - 2.2. Describe ovulation.

3. Explain the hormonal control of female reproduction.
   - 3.1 Describe the glands and hormones produced.
   - 3.2 Describe the cyclic interplay of these hormones which regulate the menstrual cycle including the ovarian and uterine cycles.

C. FERTILIZATION AND DEVELOPMENT

1. Describe the process of fertilization and where it normally occurs.

2. Describe the major stages of development occurring within the germinal and embryonic time frames.

3. Summarize the events of the fetal time frame.

4. Describe the cardiovascular changes associated with birth.