

**Biology 152 — Fall 2003*****Anatomy and Physiology for Nursing*****INTRODUCTION**

Biology 152 is the first 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, nutrition and development.

**INSTRUCTORS****Biology**

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**Nursing**

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**TEXTBOOKS****Biology - Required**

Martini, F. (2004). *Fundamentals of Anatomy and Physiology*. (6<sup>th</sup> Ed.) Benjamin Cummings, San Francisco.

Martini, F. and Welch, K. (2004). *Applications Manual: Fundamentals of Anatomy and Physiology*. (6<sup>th</sup> Ed.) Benjamin Cummings, San Francisco.

Martini, F. (2004). *Martini's Atlas of the Human Body*. Benjamin Cummings, San Francisco.

NB the above three books are packaged and sold together.

Camosun College, Department of Biology. *Biology 152: Course Outline, Learning Objectives and Laboratory Directions* — Fall 2003.

**Optional**

Seiger, C. (2004). *Study Guide: Fundamentals of anatomy and physiology*. (6<sup>th</sup> Ed.) Benjamin Cummings, San Francisco.

\*Kapit, W. and Elson, L. (2002). *The Anatomy Coloring Book*.  
New York, NY: Harper & Row.

\*or other similar publication

**Nursing – Required for students registered in nursing.****For others, texts are optional.**

Dugas, B., Esson, L. & Ronaldson, S. (1999). *Nursing foundations: A Canadian Perspective*. (2<sup>nd</sup> Ed.) Scarborough, Ontario: Prentice Hall Canada Inc.

Estes, M. (2002). *Health assessment & physical examination*. (2<sup>nd</sup> Ed.) Toronto: Delmar Publishers.

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

**Lab requirements**

1. Lab coats. Disposable lab coats are acceptable and can be used for the two semesters of biology.
2. Binder for laboratory modules and assignments with lined and blank loose-leaf paper.
3. Colored pencils.

## EVALUATION

There will be two theory examinations during the term, a midterm laboratory examination and final comprehensive theory and laboratory examinations. Theory examinations will include both the nursing and biology components of the course. Marks may also be awarded for assignments, lab reports and/or class participation.

Exam # 1	.....	15%
Exam #2	.....	20%
Final comprehensive	.....	35%
Assignments.	.....	5%
Midterm Lab Exam	.....	10%
Final comprehensive Lab Exam	.....	15%

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 the 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 RESPONSIBILITIES.

The following letter grades will be applied to examinations and other forms of evaluations in this course:

A+	=	95% - 100%	C+	=	65% - 69%
A	=	90% - 94%	C	=	60% - 64%
A-	=	85% - 89%	D	=	50% - 59%
B+	=	80% - 84%	F	=	less than 50%
B	=	75% - 79%			
B-	=	70% - 74%			

## STUDENT RESPONSIBILITIES

1. Students are expected to hand in any required reports on time.
2. Late reports will receive a penalty of 10% per day for each weekday. If a report is due on Friday, a penalty of 10% will be applied to Saturday/Sunday period.
3. 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.
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 an 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 cover 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 final comprehensive laboratory examination will be weighted 25% of the course mark.
  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 or receiving unauthorized information to or from another student during any 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.

### **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 152 COURSE SCHEDULE FALL 2003**

The following is a **tentative** schedule of lectures and labs. Changes may be announced in class.

Week	Dates	Lecture Topics	Lab Activities
1	Sept 1 Sept 2 – 5	<b>LABOUR DAY</b> Homeostasis and membrane transport	<b>COLLEGE CLOSED</b> <b>LAB 1:</b> Lab Safety, Anatomical Terminology and Systems Overview
2	Sept 8 – 12	Tissues Integumentary System <i>Nursing – Intro to Nursing Applications</i>	<b>LAB 2:</b> Introduction to Microscopy and Tissues
	Sept 15 – 19	Skeletal System <i>Nursing – Skin integrity</i>	<b>LAB 3:</b> Tissues (cont'd) and Integumentary System
4	Sept 22 Sept 23 – 26	<b>EXAM #1</b> Skeletal and Muscular Systems	<b>LAB 4:</b> Intro to Skeletal System and Axial Skeleton
5	Sept 29-Oct 3	Muscular System <i>Nursing – Movement and exercise</i>	<b>LAB 5:</b> Appendicular Skeleton and Articulations
6	Oct 6 – 10	Neural Tissue & Action potential Respiratory System	<b>LAB EXAM #1</b>
7	Oct 13 Oct 14 – 17	<b>THANKSGIVING DAY</b> <i>Nursing – temperature &amp; respiratory regulation</i>	<b>COLLEGE CLOSED</b> <b>LAB 6:</b> Muscular System
8	Oct 20 – 24	Respiratory System	<b>LAB 7:</b> Respiratory System
9	Oct 27 – 31	Endocrine System <i>Nursing – Sleep</i>	<b>LAB 8:</b> Respiratory Physiology
10	Nov 3 Nov 4 – 7	<b>EXAM #2</b> Endocrine System	<b>LAB 9:</b> Endocrine System
11	Nov 11 Nov 10 – 14	<b>REMEMBRANCE DAY</b> Endocrine System	<b>COLLEGE CLOSED</b> <b>LAB 10:</b> Cardiovascular Anatomy
12	Nov 17 – 21	Cardiovascular System <i>Nursing – Cardiovascular 1</i>	<b>LAB 11:</b> Cardiovascular – Blood
13	Nov 24 – 28	Cardiovascular System	<b>LAB EXAM #2</b>
14	Dec 1 – 5	Cardiovascular System <i>Nursing – Cardiovascular 2</i>	<b>LAB 12:</b> Cardiovascular Physiology
15	Dec 8- 16	<b>FINAL COMPREHENSIVE EXAM ( Date TBA)</b>	

## 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.
- demonstrate the ability to apply knowledge of anatomy and physiology gained through laboratory activities to the clinical setting.
- help clients by explaining basic anatomy and physiology, nutrition and pharmacology in the maintenance of health and prevention of disease.

It is important that you are familiar with material that has already been covered in the prerequisite courses, Biology 12 or 080 and Chemistry 11. This information is necessary in order to understand concepts taught in Biology 152. Students are expected to review this prerequisite material, if necessary, as it too is testable. The learning outcomes for Biology 12 can be accessed at the following website:

<http://www.bced.gov.bc.ca/irp/curric/biolo.htm#gr12>

N.B. For this course you will obtain information from several sources including lectures, class discussions, textbooks, videos, labs and clinical courses. Do not rely exclusively on any one, or only some of the sources.

## **COURSE OBJECTIVES**

### **UNIT I**

#### **A. INTRODUCTION**

1. Explain the concept of homeostasis and its significance for living organisms.
2. Explain, with examples, the importance of negative feedback in the maintenance of homeostasis and give examples.
3. Locate and identify the closed body cavities and their subdivisions and identify the major organs within the cavities.
4. Demonstrate the ability to correctly use standard anatomical terms and describe
  - anatomical position
  - surface terminology including quadrants and regions
  - directional terminology
  - sectional terminology including planes and cavities
5. Identify the internal organs associated with the quadrants and regions.

#### **B. THE CELL AND CELLULAR PHYSIOLOGY**

1. Describe membrane transport and its importance to cell function.
2. Describe endocytosis and exocytosis and the processes in which they are involved (pinocytosis and phagocytosis).
3. Distinguish amongst isotonic, hypotonic and hypertonic solutions, and describe how they affect the movement of water across cell membranes.

#### **C. TISSUES**

1. Describe the structure and give the functions and typical locations of the four principal types of tissue.
2. Describe the relationship between form and function for each type of epithelial tissue.

##### Simple

- squamous
- cuboidal
- columnar



## Stratified

- squamous
- cuboidal
- columnar
- transitional
- pseudostratified

3. Describe the role of epithelium in glandular secretion.
4. Compare the structure and function of the following types of connective tissue

## Connective tissue proper

- areolar or loose
- adipose
- reticular
- dense regular
- dense irregular

## Bone (covered later in Unit II)

## Cartilage

- hyaline
- fibrocartilage
- elastic

## Blood (covered later in the course)

5. Muscle tissue (covered later in the course)
6. Nervous tissue (covered later in the course)
7. Describe the structure of membranes at the tissue level of organization.

**D. THE INTEGUMENTARY SYSTEM**

1. Describe the structure and function of the epidermis, the process of keratinization and pigmentation.
2. Describe the structure and function of the dermis including the main regions and their inclusions.
3. Describe the structure and function of the hypodermis.

4. Describe the function of the integumentary system and its derivatives.
5. Describe the structure, location and function of the glands of the integumentary system.

## **UNIT II**

### **A. BONE AND THE SKELETAL SYSTEM**

1. Describe the overall functions of the skeletal system.
2. Describe the classification of bones by shape.
3. Identify major types of bone markings and explain their significance.
4. Describe the microstructure of bone.
  - lamellae, lacuna, Haversian canal
5. Describe the roles of osteoblasts, osteocytes and osteocytes, mineral salts and collagen fibers.
6. Identify and describe the anatomy of a typical long bone.
  - epiphysis, epiphyseal plate and epiphyseal line, diaphysis, periosteum, endosteum, medullary cavity, articular cartilage
7. Identify and describe the anatomy of a typical flat bone.
8. Describe the development and growth of bone.
  - distinguish between ossification and calcification.
  - describe intramembranous ossification.
  - describe endochondral ossification.
9. Identify the major bones of the axial skeleton and the appendicular skeleton.

**AXIAL SKELETON****The skull – Bones and Landmarks****Cranium**

- parietals (2)
- temporals (2)
  - external auditory meatus, mastoid process
- frontal
  - sinus
- occipital
  - foramen magnum, occipital condyles
- sphenoid
  - sella turcica
- ethmoid
  - cribriform plate, conchae

**Facial**

- maxilla
- lacrimals
- mandible

**Ossicles**

- malleus
- incus
- stapes

**Hyoid****The Vertebral Column, Ribs and Sternum****Vertebrae**

- cervicals
- thoracics
- lumbar
- sacrum
- coccyx

**Ribs**

- true and false, including floating

**Sternum**

- manubrium, body, xiphoid process

## THE APPENDICULAR SKELETON

### Upper Limb

#### Pectoral girdle

- scapula
- clavicle

#### Arm

- humerus -head, greater and lesser tubercles, deltoid tuberosity
- radius - head, neck, radial tuberosity
- ulna -olecranon process
- carpals, metacarpals, phalanges

### Lower Limb

#### Pelvic girdle

- coxa or pelvic bone  
pubis, ischium, ilium, acetabulum, obturator foramen, iliac crest, anterior superior iliac spine, ischial spine, pubic symphysis

#### Leg

- femur  
head, neck, greater and lesser trochanters, medial and lateral condyles
- tibia  
head, medial and lateral condyles, tibial tuberosity, medial malleolus
- fibula  
head, lateral malleolus
- patella
- tarsals
- metatarsals
- phalanges

**B. ARTICULATIONS**

1. Describe and use the functional and structural classifications of joints
2. Name and give examples of fibrous, cartilaginous and synovial joints in terms of structure and function.
3. Describe the structure of a synovial joint and the functions of its components, including bursae and tendon sheaths.
4. Briefly describe the structural features of the following joints:

**Shoulder**

- bones involved: humerus, scapula, clavicle
- articulating surfaces

**Elbow**

- bones involved: radius, ulna, humerus
- articulating surfaces

**Hip**

- bones involved: pelvis, femur
- articulating surfaces

**Knee**

- bones involved: femur, tibia, fibula, patella
- articulating surfaces
- cartilages: medial and lateral menisci
- ligaments: patellar, medial and lateral collateral, cruciate

5. Describe the relationship between joint structure and mobility, with reference to the joints above.

### C. THE MUSCULAR SYSTEM

1. Identify and compare the characteristics and overall functions of the three types of muscle tissue.
2. Describe the structure of a whole skeletal muscle.
  - epimysium, perimysium, endomysium, fascicle, fascia, sarcolemma, nerves and blood vessels
3. Describe the microstructure of a skeletal muscle fibre (cell).
  - sarcolemma, sarcoplasm, sarcoplasmic reticulum, terminal cisternae, transverse tubules, triad, myofibrils, myofilaments: thin (actin), thick (myosin), sarcomere
4. Describe the transmission of an action potential at a neuromuscular junction.
  - describe the structure of a neuromuscular junction (presynaptic terminal, synaptic vesicles, synaptic cleft, postsynaptic terminal, receptors)
  - describe the synaptic process in terms of the function of calcium, acetylcholine, acetyl cholinesterase, sodium channels.
5. Describe the key steps involved in the contraction of a skeletal muscle fibre.
6. Describe the following aspects of whole muscle physiology: excitatory stimuli, types of contraction, fatigue, oxygen debt, exercise and heat production.
7. Identify the following muscles/muscle groups and describe their actions:

#### **Head muscles**

masseter  
temporalis  
sternocleidomastoid  
trapezius  
extraocular eye muscles

#### **Thoracic muscles**

intercostals  
diaphragm

#### **Abdominal muscles**

rectus abdominis  
internal and external oblique

#### **Perineal muscles**

sphincter ani externus  
sphincter urethrae

levator ani  
bulbospongiosus

**Upper limb muscles**

trapezius  
deltoid  
rhomboids  
latissimus dorsi  
pectoralis minor and major  
biceps and triceps brachii

**Lower limb muscles**

gluteus maximus and medius  
adductor group  
quadriceps femoris  
tensor fasciae latae  
sartoris  
hamstrings  
gastrocnemius  
soleus  
tibialis anterior

**UNIT III****NEUROPHYSIOLOGY**

1. Explain how the resting potential is created and maintained.
2. Describe the events involved in the generation and propagation of an action potential.
3. Discuss the factors that affect the speed with which action potentials are propagated.
4. Describe the structure of a synapse and explain the mechanism involved in synaptic transmission.
5. Describe the major kinds of neurotransmitters and neuromodulators and discuss their effects on postsynaptic membranes.

## UNIT IV

### 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 structure and microstructure of the lungs
  - visceral and parietal pleurae, the pleural cavities and their relationship to the mediastinum
  - alveoli and pulmonary interstitium
4. Describe the relationship between pulmonary perfusion and gaseous exchange.
5. Distinguish between internal, external and cellular respiration.
6. Describe the mechanisms of pulmonary ventilation
  - atmospheric pressure, intrapulmonary and intrapleural pressures
  - muscle actions and pressure changes
  - distinguish between quiet and forced breathing
7. Describe the influence of the following factors on ventilation
  - airway resistance
  - compliance
  - interstitial elasticity
  - surface tension (role of surfactant)
8. Identify and distinguish the following lung volumes and capacities
  - tidal volume
  - inspiratory reserve volume
  - expiratory reserve volume
  - residual volume
  - vital capacity
  - total lung capacity
  - forced expiratory volume



9. 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
  
10. Describe how oxygen is transported in blood including loading and unloading
  - oxygen-hemoglobin saturation/dissociation curve
    - effect of temperature
    - effect of pH (Bohr effect)
    - effect of 2,3-bisphosphoglycerate
  - the importance of fetal hemoglobin
  - effects of carbon monoxide and high altitude on oxygen transport
  
11. Describe how carbon dioxide is transported in the blood including loading and unloading
  - interconversion of carbon dioxide, carbonic acid and bicarbonate
  - role of carbonic anhydrase
  - roles of the plasma and red blood cell in carbon dioxide transport
  - function of carbaminohemoglobin
  - the chloride shift
  - effect of carbon dioxide concentration on plasma pH
  
12. Describe the control of ventilation
  - the location and role of the respiratory centers
  - the chemical control of ventilation centers in terms of
    - chemoreceptor locations
    - effect of pH in the CSF
    - effect of  $p\text{CO}_2$
    - effect of  $p\text{O}_2$
  - the baroreceptor reflexes

## 13.UNIT V

### THE ENDOCRINE SYSTEM

1. Describe the major chemical classes of hormones and the general mechanisms of hormone action.
2. Describe the functional organization of the endocrine system in terms of the interaction of hormones with their target tissues.
3. Explain the term half-life in relation to circulating hormone levels.
4. Describe the interaction of hormones with their target tissues in terms of hormone receptors
  - classify hormone receptors as either membrane-bound or intracellular and distinguish the mechanism of action of each , providing examples
  - describe the response of some target cells to hormone stimulation in terms of “down” or “up” regulation
5. Describe the location, structure endocrine function of the:
  - hypothalamus
  - anterior and posterior pituitary glands
  - adrenal glands (cortex and medulla)
  - thyroid gland
  - parathyroid gland
  - pancreas
    - describe the structure of the islets of Langerhans.

## UNIT VI

### THE CARDIOVASCULAR SYSTEM

#### A. ANATOMY

1. Describe the components of the circulatory system and identify the major circulatory subsystems.
2. Identify the blood vessels listed in the lab manual and define the areas they supply and drain.

## B. BLOOD

1. Discuss the composition and functions of plasma.
2. Describe the origin, production and characteristics of the formed elements of blood.
  - erythrocytes, leukocytes and platelets
3. Describe the structure of hemoglobin and its functions.
4. Explain the production, degradation and recycling of erythrocytes.
5. Categorize leukocytes on the basis of their characteristic structures and functions.
6. Explain the processes associated with hemostasis
  - describe the three phases of hemostasis: vascular, platelet and coagulation
  - discuss the regulation of the three phases
  - identify specific clotting factors and the significance of calcium ions and vitamin K in blood coagulation
7. Explain the basis of blood typing of ABO and Rh antigens and the situations that may lead to incompatibilities.

## C. CARDIOVASCULAR PHYSIOLOGY

Cardiovascular physiology will be taught in the first and second semesters. Some of the following topics may not be covered in semester 1.

1. Define stroke volume and cardiac output, discuss the influencing factors and effects of alterations on the cardiovascular system.
2. Discuss factors that affect heart function.
3. Discuss the physiology of blood pressure, blood flow and capillary exchange.
  - explain the mechanisms that regulate blood flow through the vessels
  - describe the factors that influence and regulate blood pressure.
  - describe the mechanisms associated with the movement of fluids between capillaries and interstitial spaces.
4. Describe the events involved in generating an action potential in cardiac muscle and show the importance of calcium ions to the contractile process.
5. Discuss the function of cardiac nodal and conducting cells.

6. Describe the components of the cardiac conducting system and their functioning.
7. Explain the events of the cardiac cycle and relate heart sounds to specific events of the cycle.
8. Explain the electrical events associated with an electrocardiogram, describe an ECG tracing and relate it to cardiac contraction and relaxation, valvular action and blood flow through the heart.
9. Discuss the hormones that influence cardiovascular function.